UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

In Reply Refer To:
SWR-02-SA-6176:JSS

OCT -7 2003

Calvin C. Fong
Chief, Regulatory Branch
U.S. Army Corps of Engineers
333 Market Street
San Francisco, California 94105-2197

Dear Mr. Fong:

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion based on our review of the proposed Santa Fe Pacific Partners (SFPP) Concord to Sacramento Petroleum Products Pipeline project in the Suisun Bay, lower Sacramento River, and Delta watersheds, and its effects on endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha)*, threatened Central Valley spring-run Chinook salmon *(O. tshawytscha)*, threatened Central Valley steelhead *(O. mykiss*) and threatened Central California Coast steelhead *(O. mykiss*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). Your May 14, 2003, submission of a completed request package for initiation of formal consultation was received on May 16, 2003.

This biological opinion (Enclosure 1) is based on information provided during the October 18, 2002, March 5, 2002, March 29, 2002, December 12, 2002, May 27, 2003, and August 11, 2003, meetings between staff from NOAA Fisheries, the U. S. Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (FWS), California State Lands Commission (CSLC), California Department of Fish and Game (CDFG), and SFPP, the project's biological assessment (BA), the project's Joint Aquatic Resources Permit Application (JARPA), the CSLC's draft Environmental Impact Report (EIR) for the project, as well as other sources of information. A complete administrative record of this consultation is on file at the Sacramento, California, field office of NOAA Fisheries.

The biological opinion concludes that the project as proposed by SFPP and permitted by the Corps is not likely to jeopardize the continued existence of the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead, nor is it likely to result in the adverse modification of Sacramento River winter-run Chinook salmon critical habitat. Because NOAA Fisheries believes that there will be some incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and Central California

Coast steelhead as a result of the project's implementation, an incidental take statement is also included with the biological opinion. The incidental take statement includes reasonable and prudent measures that NOAA Fisheries believes are necessary and appropriate to reduce, minimize, and monitor project impacts to listed species. Terms and conditions to implement the reasonable and prudent measures are presented in the incidental take statement and must be adhered to in order for the take exemptions of section 7 (o)(2) of the ESA to apply (16 U.S.C. 1536 (o)(2)). The incidental take coverage provided by this biological opinion covers the actions of the construction phase and the routine monitoring and repair of the pipeline during its operational lifetime. It does not provide for the incidental take of listed salmonids as a result of accidental spills of petroleum products during the lifetime of the pipeline.

The biological opinion also provides conservation recommendations for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and Central California Coast steelhead. These include conservation measures described in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan, support of aquatic and riparian restoration efforts in the action area, and support of salmonid monitoring efforts throughout the action area.

Also enclosed are NOAA Fisheries' Essential Fish Habitat (EFH) Conservation Recommendations for Chinook salmon (*Oncorhynchus tshawytscha)*, starry flounder (*Platichthys stellatus*), English sole (*Parophrys vetulus*) and northern anchovy (*Engraulis mordax*) as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq*.; Enclosure 2).

The Corps has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed response in writing to NOAA Fisheries that includes a description of the measures proposed for avoiding, mitigating, or offsetting the impact of the activity on EFH, as required by section 305(b)(4)(B) of the MSA and 50 CFR 600.920 (j) within 30 days. If unable to complete a final response within 30 days of final approval, the Corps should provide an interim written response within 30 days before submitting its final response.

If you have any questions regarding this response, please contact Jeffrey Stuart in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Stuart may be reached by telephone at (916) 930-3607 or by Fax at (916) 930-3629.

Sincerely,

for James H. Lecky

Rodney R. McInnis
Acting Regional Administrator

Enclosures (2)

cc: NOAA Fisheries-PRD, Long Beach, CA
Stephen A. Meyer, ASAC, NOAA Fisheries, Sacramento, CA
Molly Martindale, U.S. Army Corps of Engineers, San Francisco District, 333 Market Street, San Francisco, California 94105-2197
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Eric Tattersall, Department of Fish and Game, Region 2, Yountville, California
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Stephen Leach, URS Corp., 500 12th Street, Suite 200, Oakland, California 94607-4014

Enclosure 1

BIOLOGICAL OPINION

Agency: U.S. Army Corps of Engineers, San Francisco District

Activity: Santa Fe Pacific Partners Concord to Sacramento Petroleum Products Pipeline Project

Consultation Conducted By: Southwest Region, National Marine Fisheries Service

Date Issued: OCT - 7 2003

I. CONSULTATION HISTORY

On October 18, 2001, a meeting was held at the U.S. Army Corps of Engineers (Corps) office in Sacramento with Mike Finan, Jane Hicks, and Ed Wylie (Corps), Diane Windham and Susan Boring (National Marine Fisheries Service [NOAA Fisheries]), Steve Leach (URS Corporation [URS]), and Dave Corman (Santa Fe Pacific Partners, LP [SFPP]) to discuss wetland and aquatic resources issues and identify action items for the proposed SFPP Concord to Sacramento Petroleum Products Pipeline project. The Corps and NOAA Fisheries provided feedback on resource issues and permitting requirements.

On February 20, 2002, a draft of the survey workplan was submitted to the Sacramento office of NOAA Fisheries for review.

On March 5, 2002, a meeting was held at the U.S. Fish and Wildlife Service (FWS) offices in Sacramento with Justin Ly (FWS), Jeff Stuart (NOAA Fisheries), Jenny Marr and Eric Tattersall (California Department of Fish and Game [CDFG]), Ed Wylie (Corps), Judy Brown, Steve Jenkins, and Sarah York (California State Lands Commission [CSLC]) and the project applicants to discuss agency comments on the draft survey workplan.

On March 29, 2002, the final survey plan was distributed to FWS, NOAA Fisheries, and the Corps. The final survey plan incorporated the agencies' earlier comments.

On October 24, 2002, copies of the biological assessment (BA) and Joint Aquatic Resources Permit Application (JARPA) for the proposed project were received by the Sacramento offices of NOAA Fisheries.

On December 12, 2002, a meeting was held at the Corps' office in Sacramento to discuss project alternatives. Attending the meeting were representatives from the Corps, SFPP, URS, NOAA Fisheries, CDFG, CSLC, Central Valley and San Francisco regions of the State Water Quality Control Boards (Regional Boards) and Aspen Consultants.

On May 16, 2003, NOAA Fisheries received a letter from the San Francisco District of the Corps initiating consultation for the SFPP Concord to Sacramento Petroleum Products Pipeline project.

On May 27, 2003, a meeting was held at the FWS office in Sacramento to discuss the Draft Environmental Impact Report (EIR) and changes to the proposed routing to avoid sensitive plant and animal species. The applicants verbally requested a draft biological opinion from NOAA Fisheries, however the Corps had not followed this up with a written request. In attendance were representatives from the FWS, NOAA Fisheries, URS, SFPP, CSLC, and Aspen Consultants.

On June 16, 2003, the Draft EIR was received by the Sacramento offices of NOAA Fisheries from the CSLC.

On June 18, 2003, NOAA Fisheries responded to the Corps May 16, 2003, request for consultation indicating that the initiation package was sufficient and that the expected date for completion of the biological opinion is on or about September 28, 2003.

On August 11, 2003, a meeting was held at the offices of FWS in Sacramento SFPP, URS, CSLC, FWS, NOAA Fisheries, the Corps, and CDFG to discuss the status of the consultation and slight variations in the pipeline route to accommodate comments on the Draft EIR concerning the Peyton Slough section of the alignment.

II. DESCRIPTION OF THE PROPOSED ACTION

The San Francisco District of the Corps has requested formal consultation pursuant to section 7 of the Endangered Species Act (ESA) in order to permit the construction of the SFPP Concord to Sacramento Petroleum Products Pipeline project under the authority of section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act. The pipeline will replace the existing 14-inch pipeline with a new 20-inch pipeline to increase delivery of the applicant's petroleum products to the northern Central Valley of California and east into the State of Nevada. The pipeline will begin at the present SFPP Concord Station, north of the City of Concord in Contra Costa County, and terminate at the existing SFPP Sacramento Station in the City of West Sacramento, Yolo County, California. The proposed pipeline is approximately 69 miles in length and will carry refined petroleum products including gasoline, diesel fuel, and jet fuel. The designed maximum operating pressure for this new line will be 1,350 pounds per square inch (psi) with an estimated service life of 50 years.

The current capacity of the existing 14-inch pipeline is 152,000 barrels per day (BPD) with a current peak demand of 137,000 BPD. With a forecasted annual increase in demand of 2.5%, the existing pipeline will reach its maximum capacity in 2006. The proposed 20-inch pipeline will have a maximum capacity of 200,000 BPD and continue to meet the expected demand for several more decades.

SFPP intends to discontinue the use of most of its existing pipeline for conveying petroleum products when the new pipeline becomes operational. SFPP intends to retire the existing pipeline in place after cleaning it and purging it with inert gas. SFPP has future plans to utilize this retired pipeline possibly as a means of conveying reclaimed water, or the routing of fiber optics or other telecommunication lines along this alignment.

The proposed pipeline system will include 68.4 miles of new 20-inch pipe, 0.4 miles of new 14-inch pipe, 1.1 miles of SFPP's existing 14-inch pipe (beneath the Carquinez Strait), and 0.8 miles of new 12-inch pipe. In order to accomplish the goals of this project, SFPP will have to undertake the following activities:

- Upgrading of the existing terminals in Concord and West Sacramento, California to handle the expansion in capacity arising from the new 20-inch pipeline.
- Defining locations of storage and construction assembly yards within the proposed pipeline alignment.
- Clearing of cross-country right of way (ROW) along the proposed pipeline alignment.
- Cross-country trenching along the pipeline alignment in upland areas.
- Welding, inspection, coating and hydrostatic testing of pipe sections.
- Cross country construction, lowering and tying in of the pipeline and backfilling of the exposed trench.
- Crossing of waterways by one of the following methods: open cut, slick and conventional boring, or horizontal directional drilling (HDD).
- Cleaning up and restoration of the ROW following construction activities in the ROW.
- Operation and maintenance of the pipeline, including ROW inspections, pigging of the pipeline, leak testing, valve inspections and testing, and regular hydrostatic testing of the pipeline.
- Implementation of an emergency response plan for any leaks or spills occurring along the new pipeline.

Several of the project construction components will not impact aquatic resources and therefore will not have demonstrable effects upon listed salmonids in the project area. These include the modifications to the pipeline terminals, the placement of construction staging areas, welding, coating and inspection activities, laying down and backfilling of upland pipeline trenches, and the crossing of highways, railroads, and other pipelines along the proposed route. These project components will not be discussed further in this biological opinion as no adverse effects to listed salmonids is anticipated from their implementation. The remaining project activities that involve work in or near waterbodies may adversely affect listed salmonids, and are described below. A more detailed description of these activities can be found in the Draft EIR (CSLC 2003).

A. Construction Activities

1. Cross-Country ROW Clearing

A 100-foot-wide ROW typically would be used for rural construction. Vegetation would be cleared from the construction ROW and then graded to provide for safe and efficient operation of construction equipment, and to provide space for temporary storage of spoil material and salvaged topsoil. In general, the width of the ROW clearings would be kept to a practical minimum to avoid undue disturbance of adjacent resources.

Topsoil removed during the clearing and grading operations would be segregated from subsoils. At a minimum, the first 6 inches of surface soil typically would be separated. These topsoils would be preserved for subsequent restoration activities on the ROW.

Portions of the pipeline construction will be in wet soil conditions. In some situations the equipment would have to be operated from timber mats. Excavations in wet soil conditions are generally performed with an excavator type of backhoe. After the construction phase is completed, the area would be returned as close as possible to its original condition.

2. Cross-Country Trenching

Typically, a three-foot-wide by six-foot-deep trench would be excavated, and the total work area would be up to 100 feet wide. The trench would be excavated using backhoes, ditching machines and track hoes. An exception to the mechanical excavation would be hand-digging using air tools to locate buried utilities, such as other pipelines, cables, water mains, and sewers. No blasting is anticipated during the construction of the proposed pipeline.

It is possible that contaminated soil may be excavated during construction, especially in older industrial areas with shallow groundwater. Contaminated soil would be used as backfill only with prior agency approval and in the place of origin. Contaminated soil that cannot be returned as backfill would be disposed of or treated at an appropriate, permitted, waste facility.

3. Waterway Crossings

Construction of the proposed project would result in crossing *64* waterbodies ranging from small creeks to large channels (see Tablel [attached]). The construction of each crossing is expected to require an average of 5 to 10 days. The construction methods proposed for these crossings would be either an open cut, slick or conventional bore, or horizontal directional drill (HDD). Each technique is described below.

a. *Open Cut*

The open cut technique for small drainages would require a trench to be excavated from bank-to-bank. This would require equipment such as backhoes, bulldozers, and draglines to excavate the ditch. The trench would be excavated to allow the pipe to be placed approximately 5 feet below the streambed to ensure the pipe is not exposed by streambed scour. Dewatering techniques are not proposed for these crossings as the entire length of pipeline for the crossing would be pre-welded with all joints coated, and if necessary counterweighted before lowering the pipeline into place. The installed pipe would then be backfilled with spoils. The creek or drainage would be returned to its original configuration, substrate replaced, banks stabilized, and revegetated as necessary.

b. *Slick and Conventional Boring*

Slick and conventional boring would be conducted at some canal and flood control channel crossings. A bore pit would be excavated on each side of the waterway. These pits, approximately 25 to 30 feet long by 10 to 15 feet wide, would be excavated with a backhoe outside of the natural channel boundaries. Depth of the pits would depend on final pipeline depth below grade. The boring equipment is lowered into the pit and the drilling bore is advanced into the substrate. The welded pipe sections and, if needed, a casing, are advanced over the drill shaft into the bore hole. Spoils from the excavation would be placed alongside the pits outside of the channel for future use as backfill. Minimum buffer zones of 15 feet for entry and exit points on either side of the stream and a 5-foot vertical clearance beneath the streambed would be maintained to minimize the potential environmental impacts resulting from the crossing activities.

Any groundwater encountered during drilling would be discharged per Regional Water Quality Control Board requirements. The procedure employed would be determined during final design. Upon completion of the pipeline installation, the excavated areas would be backfilled, compacted, re-contoured, and restored to natural conditions.

c. *HDD*

HDD is a highly specialized boring technique that would be used to drill under Walnut and Grayson Creeks, Cordelia Slough, and other large waterbodies. This technique is used in large-scale waterbody crossings in which a fluid-filled pilot bore is drilled and then enlarged to the size required for the pipeline. Lubrication containing water and bentonite clay, referred to as drilling mud, would be used to aid the drilling, coat the walls of the bore, and to maintain the bore's opening. A wire-line magnetic guidance system would be used to ensure that the angle, depth, and exit point abide by the project's detailed engineering plans. Once the hole is approximately 12 inches larger than the pipe, the pipeline is pulled through the drilled hole from the point of entry to the point of exit. The workspace requirements for the HDDs extend to an area 200 feet wide and 200 feet long for the drilling equipment setup and a long linear alignment for the welded pipe laydown. HDDs are drilled from groundlevel at the entrance site and subsequently surfaces from groundlevel at the exit point; however, mud pits may need to be excavated to retain the drilling mud returning from the bore hole.

4. Cross-Countrv Construction. Clean up. and Restoration

Following the backfilling of the trench, all construction waste and debris will be removed from the work site and disposed of in the appropriate manner. In areas where cross-country construction would occur, debris would be removed, the ROW restored and, where appropriate, revegetated. Steps would be taken to minimize erosion, restore the natural ground contour (accounting for trench settling), reestablish plant growth where appropriate, and allow for natural surface drainage. As stipulated in agreements with the landowner or jurisdictional agency, all completed construction areas and temporary access roads would be returned as nearly as possible to their original condition and level of productivity. All restoration and revegetation would be completed as agreed to with the landowner or jurisdictional agency.

B. Long Term Operation and Maintenance of the Pipeline

1. Pipeline Monitoring and Leak Detection

The project pipeline will utilize a computerized system of pipeline communications and system control, referred to as the Supervisory Control and Data Acquisition (SCADA) system. The function of SCADA is to remotely monitor the status of the pipeline with sensing devices distributed along the length of the pipeline. The pipeline system is equipped with various safety devices such as pressure sensing devices and electrical current and temperature measuring devices to assure reliable and safe operation of the pumps. The pipeline is protected by pressure control valves as well as pressure measuring devices and pressure relief valves, allowing operators and controllers to use the SCADA system to automatically adjust the pressure and flow rate of the pipeline to provide for safe operation of the pipeline system. Leak detection, including detection of small leaks, would be accomplished by a variety of methods including monitoring SCADA and other data; aerial/ground pipeline patrol; third party reports; internal inspection tools; external pipe inspection; and static pressure monitoring.

A key element in preventing small leaks is SFPP's internal inspection program. Pigs or scrapers are devices inserted into the pipeline at launching points and retrieved at receiving points called scraper traps. Pigs are used to clean and/or inspect the pipeline. "Smart" pigs are devices used to inspect and record the condition of the pipe. Smart pigs detect where corrosion or other damage has affected the wall thickness or shape. SFPP would perform a "baseline" smart pig run for the entire pipeline after the completion of construction. Once in operation, additional smart pig runs would be performed every five years in accordance with U.S. Department of Transportation (DOT) regulations. The information from the pig runs are used to define areas of corrosion or other pipeline damage, which are inspected and repaired as necessary to prevent leaks from occurring. In addition, SFPP has a steel mill inspection program to ensure that fabricated pipe meets or exceeds the minimum applicable American Petroleum Industry (API) specifications and complies with the company's specifications.

The pipeline route will be visually inspected at least bi-weekly by line rider patrols in accordance with DOT requirements (49 CFR Part 195) to locate third-party construction along the alignment, verify the operation of the cathodic protection system for external corrosion control, or discover other factors that might threaten the integrity of the pipeline. Additionally, inspection of highway, utility, and pipeline crossing locations would be conducted in accordance with State and Federal regulations. More thorough inspections at key locations would be conducted quarterly and annually.

As required by the DOT, system inspection and maintenance would include hydrostatic testing to check for pipeline leakage. Block valves will be cycled and inspected twice annually, not to exceed intervals of seven months to ensure proper operation (per 49 CFR 195.420). Codes do not specify inspection requirements for check valves.

2. Vegetation Maintenance

Every 3 years vegetation growing within the ROW will be cut down and any trees or shrubs within 10 feet of the pipeline centerline will be removed. This will be done to facilitate pipeline inspection and preclude damage from tree roots.

3. Emergency Response Plan

An Oil Spill Response Plan (OSRP) prepared by SFPP has been approved by appropriate Federal, State, and local agencies (SFPP 2002). SFPP has also prepared an Emergency Plan to specify measures to be taken in emergency scenarios.

The OSRP lists third-party contractors providing manpower and equipment such as vacuum trucks, boats, oil skimmers, absorbent and skirted booms, dump trucks, portable tanks, absorbent materials, dispersants, steam cleaners, hydroblasters, cranes, and forklifts. These would include contractors located in the Bay area. In addition, SFPP operations personnel are trained in the company's Incident Command System and oil spill containment and cleanup procedures. Local emergency response providers would be notified to assist in traffic control, evacuations of homes or businesses, crowd control, ambulance and hospital services, and backup fire protection services.

a. *Pipeline Failure in Wetlands Area*

Depending on the volume of the product spill, it may be possible to make small containment dikes/berms by manually placing available soil (or sandbags) around the spill perimeter. Larger spills will require the use of mechanized equipment to construct the containment barrier. If the spill is in a tidally influenced portion of the wetland, containment berms can be constructed on three sides of the spill and an absorbent boom and pads installed on the outflow side of the spill.

b. *Pipeline Failure in a Small Creek*

Petroleum product escaping into a small creek will flow downstream with the current at the velocity of the flow. Residue from the product spill will accumulate alongside the banks of the creek on substrate and vegetation. Barriers such as a small dams will be placed across the channel of the creek ahead of the approaching spill using native soils or sandbags. The number and size of the dams will be determined by the size of the spill and the discharge of the creek. Regulating siphons, pumps or bypass pipes will be placed to maintain the containment of the spill behind the dams and pass uncontaminated water around the structure. The petroleum product can be picked up using a vacuum truck and/or absorbent booms and pads. On larger creeks where dams may not be practicable, larger sections of containment booms can be used. Waste water and product can then be taken by truck to an appropriate disposal facility for recycling or disposal.

c. *Pipeline Failure in a River*

If petroleum product is spilled into a river, the size of the spill, the volume of discharge of the river and its gradient will determine the response to the spill. In low gradient rivers that are not wide, floating booms can be installed at an angle to the flow to direct the spill to one side of the river where it can be collected by skimming or vacuuming. If the discharge is too great for booms to be manageable or the river's gradient is too steep, alternative methods need to be implemented. Initially in these circumstances, reconnaissance of the river will determine where natural current breaks and eddies occur, spilled product will collect, and where containment operations should be sited to take advantage of these points.

d. *Tank Failures*

The area surrounding a storage tank is contained within an earthen berm which is sized to contain the volume of the tank. A system of pumps and valves are integrated with the tank farm to move product from one tank to another in the case of structural failure of a tank. Contaminated soil will be removed and disposed of in the appropriate manner.

C. Proposed Conservation Measures

The applicant acknowledges that the proposed pipeline will have certain adverse effects upon listed species occurring along the pipeline alignment. The potential impacts to listed species will be mitigated by the implementation of conservation measures. For listed salmonids, the applicant's proposed conservation measures are:

- General avoidance and minimization measures, and

- Species-specific avoidance measures.

1. General Avoidance and Minimization Measures

The general avoidance and minimization measures proposed by the applicant include worker education, erosion control, implementation of a mitigation and monitoring plan, and compliance monitoring and reporting.

The Mitigation and Monitoring Plan will include provisions to evaluate the performance of the conservation measures, verify that the required measures are implemented, resolve disputes and problems, and report the results of the mitigation program to the appropriate resource agencies. Within 60 days of the completion of project construction, SFPP will submit a final compliance report to the resource agencies. The Mitigation and Monitoring Plan will require a biological monitor to be present in the field and supervise construction activities.

2. Species-specific Avoidance Measures

The applicant anticipates that temporary degradation of aquatic habitats that support listed salmonids will occur as *a* result of the activities necessary for the construction and operation of the proposed pipeline. The applicant believes that the following measures will minimize or eliminate these impacts:

- Construction Timing-construction will be timed to occur from March 1 - October 31, 2004, which has been defined by the applicant as a dry weather period when the potential for erosion and sedimentation associated with the construction activities are reduced, thus minimizing impacts to water quality.

- Erosion Control--silt fences, straw bales, or similar materials will be installed at the perimeter of all work areas within 300 feet of perennial streams with potential occurrences of Chinook salmon or steelhead (see action area below).

- Avoidance Measures--SFPP will use the existing 14-inch pipeline at the Carquinez Strait crossing which will avoid any new potential direct impacts to the aquatic habitat and species found within the strait.

- The applicant has determined that where feasible, crossings of perennial streams and sloughs will be constructed using the HDD technique or a slick/cased bore in order to avoid direct impacts to anadromous fish. A contingency plan will be developed and reviewed by the resource agencies for the possibility of an uncontrolled release of drilling mud *(i.e.,* a frac-out) resulting from the HDD process that will include work stoppage and stabilization of the spill, clean-up protocols, and continuation alternatives, including abandoning the drill or modifications to the drill protocol.

C. Action Area

The proposed pipeline alignment is located within the watersheds of the Carquinez strait, Suisun Marsh (Grizzly Bay), and the lower Sacramento River. The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area, for the purposes of this biological opinion include the following waterbodies which are assumed to contain listed salmonids:

• Walnut/Grayson Creek	(Mile Post [MP] 0.3)
• Pacheco Creek	(MP 1.6)
• Peyton Slough (post-restoration alignment)	(MP 4.0)
• Carquinez Strait	(MP 4.8)
• Cordelia Slough	(MP 19.2)
• Suisun Creek	(MP 20.5)
• Ledgewood Creek	(MP 23.3)
• Peytonia Slough	(MP 23.7)
• Laurel Creek	(MP 26.1)
• Ulatis Creek	(MP 40.7)
• Putah Creek	(MP 57.8)
• Yolo Bypass	(MP 62.0 - 66.0)

The pipeline alignment will cross these waterbodies as well as several others (64 total), and the affected area at each crossing can be assumed to reach both upstream and downstream from the crossing. The distance that the project effects can reach upstream from a crossing is assumed to be 50 feet *(i.e.,* to the upper limit of the ROW), except for the Carquinez Strait, Cordelia Slough, Peytonia Slough, and the Yolo Bypass. Project effects are assumed to extend upstream to the limits of the tidal influence at these locations. The downstream extent of project effects from crossing sites depends on the disturbance size *(e.g.,* spill size) and current volumes and velocities found in a particular watershed at the time of an incident. For the purposes of this biological opinion, the action area is assumed to extend one mile downstream from the crossing of all waterways containing salmonids. The percentage of the pipeline that traverses aquatic habitat assumed to hold salmonids is approximately 8.9 % of the total 70-mile pipeline.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following listed endangered and threatened species and designated critical habitat occur in the action area and may be affected by the proposed SFPP Concord to Sacramento Petroleum Products Pipeline:

Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha)*
Sacramento River winter-run Chinook salmon designated critical habitat
Central Valley spring-run Chinook salmon *(O. tshawytscha)*

Central Valley steelhead *(O. mykiss)*
Central California Coast steelhead *(O. mykiss)*

A. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

1. Sacramento River Winter-run Chinook Salmon ESU

The Sacramento River winter-run Chinook salmon was formally listed as threatened in November 1990 (55 FR 46515), and was reclassified as endangered under the ESA on January 4, 1994 (59 FR 440). On June 16, 1993 (58 FR 33212), NOAA Fisheries designated critical habitat for the winter-run Chinook salmon. This area was delineated as the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta, including Kimball Island, Winter Island, and Browns Island; all waters from Chipps island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Straits; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge. In the areas westward from Chipps Island, including San Francisco Bay to the Golden Gate Bridge, north of the San Francisco-Oakland Bay Bridge, this designation includes the estuarine water column and essential foraging habitat and food resources utilized by Sacramento River winter-run Chinook salmon as part of their juvenile outmigration or adult spawning migrations. Within the Sacramento River this includes the river water, river bottom (including gravel for spawning), and adjacent riparian zone used by fry and juveniles for rearing.

The first adult winter-run Chinook salmon migrants appear in the Sacramento-San Joaquin River system during the early winter months (Skinner 1962). Within the Delta, winter-run adults begin to move through the system in early winter *(i.e.,* November-December), with the first upstream adult migrants appearing in the upper Sacramento River during late December (Vogel and Marine 1991). Adult winter-run presence in the upper Sacramento River system peaks during the month of March. The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Spawning occurs primarily from mid-April to mid-August with peak activity occurring in May and June in the river reach between Keswick Dam and the Red Bluff Diversion Dam (RBDD) (Vogel and Marine 1991). The majority of winter-run Chinook salmon spawners are three years old.

Chinook salmon spawning occurs predominately in clean, loose, gravel in swift, relatively shallow riffles or along the margins of deeper runs. The fry begin to emerge from the gravel in late June to early July and continue through October (Fisher 1994), generally at night. After emergence, fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris. When the juvenile salmon reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energetic expenditures. Emigration of juvenile winter-run Chinook past the RBDD may occur as early as late July or August, but generally peaks in September and can extend into the next spring in dry years (Vogel and Marine 1991). In the mainstems of larger rivers, juveniles tend to migrate along the margins of the river, rather than in the increased velocity found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, the juvenile salmon inhabit the surface waters (Healy and Jordan 1982). Juvenile winter-run Chinook salmon occur in the Sacramento-San Joaquin Delta from October through early May based on data collected from trawls, beach seines, and salvage records at the State and Federal water projects (DFG 1998). The peak of juvenile arrivals is from January to March. They tend to rear in the freshwater upper delta areas for about the first two months (Kjelson *et al.* 1981, 1982). Maturing Chinook fry and fingerlings prefer to rear further downstream where ambient salinity is up to 1.5 to 2.5 $^{0}/_{00}$ (parts per thousand)(Healy 1980, 1982; Levings *et al.* 1986).

Juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels and sloughs (McDonald 1960; Dunford 1975). Cladocerans, copepods, amphipods and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson *et al.* 1982; Sommer *et al.* 2001). Shallow water habitats are more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer *et al.* 2001). Optimal water temperatures for the growth of juvenile Chinook salmon in the Sacramento-San Joaquin Delta are 54 °F to 57 °F (Brett 1952). In Suisun and San Pablo Bays water temperatures reach 54 °F by February in a typical year. Other portions of the Delta do not reach this temperature until later in the year, often not until after spring runoff has ended.

Juvenile Chinook salmon follow the tidal cycle in their movements within the estuarine habitat, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levy and Northcote 1981; Levings 1982; Healey 1991). As juvenile Chinook salmon increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tide into shallow water habitats to feed (Allen and Hassler 1986). Kjelson *et al.* (1982) reported that juvenile Chinook salmon also demonstrated a diurnal migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. During the night, juveniles were distributed randomly in the water column, but would school up during the day into the upper 3 meters of the water column. Fry remain in the estuary until they reach a fork length of about 118 mm *(i.e.,* 5 to 10 months of age). Emigration from the delta may begin as early as November and continue through May (Fisher 1994; Myers *et al.* 1998).

Winter-run Chinook salmon are particularly susceptible to extinction due to the limitations of access to suitable spawning grounds and the reduction of their genetic pool to one population (NOAA Fisheries 1997). The winter-run Chinook salmon also has lower fecundity rates than other races of Chinook salmon in the Central Valley (Fisher 1994), averaging 1000 to 2000 eggs less per female than the other runs (3,700 winter-run, 5,800 late fall, 4,900 spring-run, and 5,500 fall-run). Both environmental and anthropogenic mediated changes to the habitat have led to declines in the Sacramento River winter-run Chinook salmon populations (see Figure 1 [attached]) over the past three decades. However, the past three years have shown a modest, but positive increase in the winter-run Chinook salmon population, based upon escapement estimates.

2. Central Vallev Spring-run Chinook Salmon ESU

NOAA Fisheries listed Central Valley spring-run Chinook salmon as threatened on September 16, 1999 (50 FR 50394) Many of the same factors described above that have led to the decline of the Sacramento River winter-run Chinook salmon ESU are also applicable to the Central Valley spring-run Chinook salmon ESU, particularly the exclusion from historical spawning grounds found at higher elevations in the watersheds. Historically, spring-run Chinook salmon were abundant throughout the Sacramento and San Joaquin River systems. They constituted the dominant run of salmon in the San Joaquin River system prior to being extirpated by the construction of low elevation dams on the main tributaries of the watershed. Spring-run Chinook salmon typically spawned in higher elevation watersheds such as the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit Rivers. Currently, spring-run Chinook salmon cannot access most of their historical spawning and rearing grounds in the Central Valley due to the construction of impassable dams in the lower portions of the Central Valley's waterways. Today, the only streams that are considered to harbor naturally spawning wild stocks of spring-run Chinook are Mill, Deer and Butte creeks. All of these creeks are east-side creeks that do not have a major dam or migration barrier. Some additional spawning occurs in the Feather River mainstem and the Sacramento River. However, the genetic characteristics of these fish suggest interbreeding with both spring-run and fall-run hatchery fish. Elevated water temperatures, agricultural and municipal water diversions, regulated water flows, entrainment into unscreened or poorly functioning screened diversions, and riparian habitat degradation all have negatively impacted the spring-run Chinook salmon ESU.

Adult Central Valley spring-run Chinook salmon migrate into the Sacramento River system between March and July, peaking in May through June. They hold in coldwater streams at approximately 1500 feet above sea level prior to spawning, conserving energy expenditures while their gonadal tissue matures. They spawn from late August through early October, peaking in September (Fisher 1994; Yoshiyama *et al.* 1998). Between 56 to 87 percent of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are three years old (Calkins *et al.* 1940; Fisher 1994). Spring-run Chinook salmon fry emerge from the gravel from November to March and spend about 3 to 15 months in freshwater habitats prior to emigrating to the ocean (Kjelson *et al.* 1981). Downstream emigration by juveniles occurs from November to April. Upon reaching the Delta, juvenile spring-run Chinook salmon forage on the same variety of organisms and utilize the same type of habitats as previously described for Sacramento River winter-run Chinook salmon juveniles.

Adult escapement/spawning stock estimates for the past thirty years have shown a highly variable population for the Central Valley spring-run Chinook ESU. Even though the abundance of fish may increase from one year to the next, the overall average population trend has a negative slope during this time period (see Figure 2 [attached]). These variations in annual population levels may result from differences in individual tributary cohort recruitment levels. Central Valley spring-run Chinook salmon, like Sacramento River winter-run Chinook salmon, have a lower fecundity than the larger Central Valley fall and late-fall runs of Chinook salmon. Because the spring-run Chinook salmon ESU is confined to relatively few remaining streams and continues to display broad fluctuations in abundance, the population is at a moderate risk of extinction.

3. Central Valley Steelhead ESU

On March 19, 1998, NOAA Fisheries listed the Central Valley steelhead as threatened (63 FR 13347). Historically, Central Valley steelhead once were found throughout the Sacramento and San Joaquin drainages, where waterways were accessible to migrating fish. Steelhead historically were present in the upper San Joaquin River basin, above the current Friant Dam location. Steelhead commonly migrated far up tributaries and into headwater streams where cool, well oxygenated waters are present year-round. Currently, within the Central Valley, viable populations of naturally produced steelhead are found only in the Sacramento River and its tributaries (U.S. Fish and Wildlife Service [FWS] 1998a). Wild steelhead populations appear to be restricted to tributaries on the Sacramento River below Keswick Dam, such as Antelope, Deer, and Mill creeks, and in the Yuba River, below Englebright Dam (McEwan and Jackson 1996). At this time, no significant populations of steelhead remain in the San Joaquin River basin (FWS 1998a). However, small persistent runs still occur on the Stanislaus and perhaps the Tuolumne Rivers. Steelhead are found in the Mokelumne River and Cosumnes River, but may be of hatchery origin. It is possible that other naturally spawning populations exist in other Central Valley streams, but are not detected due to a lack of sufficient monitoring and genetic sampling of rainbow/steelhead resident fish (Interagency Ecological Program [IEP] Steelhead Project Work Team 1999).

Central Valley Steelhead are all considered to be winter-run steelhead (McEwan and Jackson 1996), which are fish that mature in the ocean before entering freshwater on their spawning migrations. Prior to the large scale construction of dams in the 1940s, summer steelhead may have been present in the Sacramento River system (IEP Steelhead Project Work Team 1999). The timing of river entry is often correlated with an increase in river flow, such as occurs during freshets and precipitation events with the associated lowering of ambient water temperatures. The preferred water temperatures for migrating adult steelhead are between 46 °F and 52 °F. Entry into the river system occurs from July through May, with a peak in late September. Spawning can start as early as December, but typically peaks between January and March, and can continue as late as April, depending on water conditions (McEwan and Jackson 1996). Steelhead are capable of spawning more than once (iteroparous) as compared to other pacific salmonids which die after spawning (semelparous). However the percentage of repeat spawning often is low, and is predominated by female fish (Busby *et al.* 1996). Steelhead prefer to spawn in cool, clear streams with suitable gravel size, water depth, and water velocities. Ephemeral streams may be used for spawning if suitable conditions in the headwaters remain during the dry season and are accessible to juvenile fish seeking thermal refuge from excessive temperatures and dewatering in the lower elevation reaches of the natal stream (Barnhart 1986).

In Central Valley streams, fry emergence usually occurs between February and May, but can occur as late as June. After emerging from the gravel, fry migrate to shallow, protected areas associated with the margins of the natal stream (Barnhart 1986). Fry will take up and defend feeding stations in the stream as they mature, and force smaller, less dominant fry to lower quality locations (Shapovalov and Taft 1954). In-stream cover and velocity refugia are essential for the survival of steelhead fry, as is riparian vegetation, which provides overhead cover, shade, and complex habitats. As fry mature, they move into deeper waters in the stream channel, occupying riffles during their first year in fresh water. Larger fish may inhabit pools or deeper runs (Barnhart 1986). Juvenile steelhead feed on a variety of aquatic and terrestrial invertebrates, and may even prey on the fry and juveniles of steelhead, salmon, and other fish species. Steelhead juveniles may take up residence in freshwater habitat for extended periods of time prior to emigrating to the ocean. Optimal water temperatures for fry and juveniles rearing in freshwater is between 45 °F and 60 °F. The upper lethal limit for steelhead is approximately 75 °F (Bjornn and Reiser 1991); temperatures over 70 °F result in respiratory distress for steelhead due to low dissolved oxygen levels.

Steelhead typically spend one to three years in freshwater before migrating downstream to the ocean. Most Central Valley steelhead will migrate to the ocean after spending two years in freshwater, with the bulk of migration occurring from November to May, although some low levels may occur during all months of the year. The out-migration peaks from April to May on the Stanislaus River whereas the American River has larger smolt-sized fish emigrating from December to February and smaller sized steelhead fry coming through later in the spring (March and April). Feather River steelhead smolts are observed in the river until September, which is believed to be the end of the outmigration period (Calfed Bay Delta Program [CALFED] 2000).

Over the past 30 years, naturally spawning steelhead populations in the Upper Sacramento River have declined substantially (Figure 3 [attached]). Central Valley steelhead are susceptible to population declines due to the scarcity of cool summer water temperatures required for the survival of juvenile fish in the valley watersheds. Many of these watersheds have been dammed for irrigation and hydroelectricity purposes and block passage to higher elevation waters. Summer water flows for many tributaries are influenced by water diversions to support agriculture. The instream flows are frequently reduced, and the ambient water temperatures in the tailwater sections of the tributaries may exceed the tolerances of juvenile steelhead, thereby causing morbidity and mortality in the fish inhabiting these sections.

4. Central California Coast steelhead ESU

On August 18, 1997, NOAA Fisheries listed the Central California Coast steelhead as threatened (62 FR 43937). Historically, Central California Coast steelhead were found throughout the coastal drainages from the Russian River watershed (Sonoma County, California) in the north to Aptos Creek (Santa Cruz County, California) in the south and eastwards to the drainages of San Francisco Bay, San Pablo Bay and portions of Suisun Bay up to the boundary of the legal Delta (Chipps Island), wherever suitable waterways were accessible to migrating fish. The eastern regions of this ESU marks the transition from the northern redwood forest ecosystem, which predominates along the coastal mountain ranges to the more xeric southern chaparral and coastal scrub ecosystems typical of the inland mountain ranges running along the western margin of the Central Valley. This region is characterized by highly erosive soils in the coast range mountains, where redwoods are the dominant vegetation type. The interior mountains are comprised of coastal shales and sedimentary soils that are also subject to high erosion rates. Precipitation in the coastal regions is higher than in the interior Central Valley and the watersheds are precipitation driven. Minimum winter water temperatures are higher in this region than in regions to the north. Only winter steelhead are found in this ESU and their migration and spawning times are similar to adjacent steelhead populations (Busby *et al.* 1996). The overall life history is very similar to the Central Valley steelhead ESU described in the previous section.

Central California Coast steelhead populations have markedly declined over the past several decades. Estimates for the populations in the Russian River and San Lorenzo River basins have indicated that current total stock abundance is less than 15 percent of their abundance 40 years ago (Busby *et al.* 1996) and what data is available for the smaller watersheds indicate a similar decline. In a 1994 to 1997 survey of 30 San Francisco Bay watersheds, steelhead occurred in small numbers at 41 percent of the sites sampled, including the Guadalupe River, San Lorenzo Creek, Corte Madera Creek, and Walnut Creek (Leidy 1997). The steelhead stocks in the watersheds of the San Francisco Bay estuary are at the greatest risk of extirpation (McEwan and Jackson 1996) due to urbanization and poor land management practices which enhances the degradation of water quality in the associated watersheds. Most of these small creeks and streams have estimated total run sizes that are fewer than 100 adult fish and are susceptible to single event population crashes.

In addition to small population sizes, there is a paucity of current data that accounts for the influence of hatchery fish on the numbers of naturally spawning fish in this ESU. Busby *et al.* (1996) estimates that for the larger watersheds in this ESU, where stocking occurs, the majority of natural production is not self-sustaining. However, the genetic integrity in smaller watersheds that have not been stocked may still be intact. Overall, the Central Coast steelhead ESU has at least two stocks of steelhead that are at high risk of extinction; the Napa River population and the populations in the San Francisco Bay tributaries. The remaining populations in this ESU are depressed, but not yet at risk for extinction according to Busby *et al.* (1996).

B. Habitat Condition and Function

The freshwater habitat of salmon and steelhead in the Sacramento-San Joaquin drainage and in the Suisun Bay watershed varies in function depending on location. Potential spawning areas are located in accessible, upstream reaches of the watersheds within the project area where viable spawning gravels and water conditions are found. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, dissolved oxygen, and silt load, all of which can greatly affect the survival of eggs and larvae.

Migratory corridors are downstream of the spawning areas and include the Delta, Suisun Bay and the Carquinez Strait. These corridors allow the upstream passage of adults, and the downstream emigration of outmigrant juveniles. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams, culverts, flood control structures, unscreened or poorly screened diversions, and degraded water quality.

Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition and function may be affected by annual and seasonal flow and temperature characteristics. Specifically, the lower reaches of streams often become less suitable for juvenile rearing during the summer. Rearing habitat condition is strongly affected by habitat complexity, food supply, or presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system *(e.g.,* the lower Cosumnes River, Sacramento River reaches with setback levees *[i.e.,* primarily located upstream of the City of Colusa] and the flood control bypasses); however, the channelized, leveed, and rip-rapped river reaches and sloughs that are common in the Sacramento-San Joaquin Delta typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Suisun Marsh, with its interconnected sloughs, offers a better rearing habitat for juvenile salmonids rearing in its waters. Fish entering from tributaries to the marsh may have better rearing conditions than fish migrating through the Delta system to the east.

C. Factors Affecting the Species and Habitat

Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and Central California Coast steelhead historically all utilized upper watershed reaches at higher elevations for holding, spawning, and rearing. For example, winter-run Chinook salmon historically spawned in the headwater reaches of the little Sacramento, McCloud and Lower Pit River systems, which had cool, stable temperatures for successful egg incubation over the summer. Populations of winter-run Chinook may have numbered over 200,000 fish (Moyle *et al.* 1989; Rectenwald 1989; Yoshiyama *et al.* 1998). Construction of Shasta Dam blocked access to all of the winter-run Chinook salmon's historical spawning grounds by 1942. Preservation of a remnant winter-run Chinook salmon population was achieved through manipulation of the dam's releases to maintain a cold water habitat in the Sacramento River below the dam as far downstream as Tehama. Other large dams constructed on the natal streams *(e.g.,* the American, Feather and Yuba Rivers) of Central Valley spring-run Chinook salmon and Central Valley steelhead resulted in the loss of access to much of the historical spawning and rearing habitat of these species. Current spawning areas located downstream of dams often are subject to flow and temperature fluctuations and consequent egg and larval mortality resulting from reservoir operation. Similarly, the dams located on Putah Creek and the drainages emptying into Suisun Marsh block migration to the upper watersheds where flows are more consistent and water temperatures less variable.

Dam construction also has led to alterations in the hydrology of the Sacramento-San Joaquin River system. This has resulted both in reductions in the volume of water flowing through the system and the timing of peak flows that stimulate migratory behavior in both juvenile and adult fish. Currently, less than 40 percent of historical flows reach San Francisco Bay through the Sacramento-San Joaquin Delta. The reduction in the peak flows has lead to alterations in the cycling of nutrients and changes in the transport of sediment and organic matter, which can lead to distinct alterations in the historical distribution of animal and plant communities upon which the juvenile salmonids depend upon for their forage base and for protective cover. Alterations in flow patterns have also reduced freshwater outflows at the western margins of the Delta. This situation has led to fluctuating salinity levels within the western margin of the Delta and has changed the location and extent of the productive mixing zone between saline and fresh water bodies. Changes in the flushing rate and increased residence time of Delta water has also enhanced the degradative effects of an increased input of contaminants and pollutants to the water system.

The Sacramento-San Joaquin Delta and Suisun Bay, historically were dominated by freshwater and brackish marsh habitat. Nearly 1,400 km^2 of freshwater marsh in the Delta region have been diked and drained primarily to create farmland. Industrialization and urbanization reclaimed even more acreage until today only about 6 percent of the original 2,200 km^2 area of native wetlands remains (Conomos *et al.* 1985, Wright and Phillips 1988). The original wetlands served as significant foraging areas for numerous species, and enhanced nutrient cycling and retention as well as acting as natural filters to enhance ambient water quality. Extensive floodplains existed adjacent to the wetlands in the transition between marsh and upland areas. Riparian forests occupied these bottomlands and provided vital habitat for rearing of both salmonids and native California inland fish during spring floods. Most of the Central Valley and Bay tributaries had significant riparian corridors associated with their watersheds, providing shade and woody debris for stream habitat. These riparian corridors and wooded bottomlands have been practically eliminated, save for a few remnant stands in the action area.

Levee construction has been a primary factor in the conversion of shallow-water habitat that was found along the margins of waterways into deeper rip-rap lined channels. Shallow-water habitats are considered essential foraging habitats for juvenile salmonids, often supporting complex and productive invertebrate assemblages. The substrate that is provided by the stone rip rap is unsuitable for the colonization of native estuarine invertebrate species. Native species *(e.g.,* clams, oligochaetes, chironomids, and amphipods) typically utilize soft substrates for colonization in the estuary rather than hard substrates. Likewise, levee construction has disconnected the rivers and Delta from their historical floodplains. Juvenile salmonids utilize floodplains for foraging and as a refuge from high flow velocities during flood events. The Cosumnes River floodplain, near its confluence with the Mokelumne River, may be the only naturally functioning floodplain left in the Central Valley, and salmonids from this watershed have been consistently found utilizing it during flooding events. Maintenance dredging of the channels can result in increased levels of suspended sediment, the formation of anoxic bottom waters, and increased saltwater intrusion into upstream areas, all of which may cause stress to fish and trigger physiological or behavioral responses.

The water quality of the Delta and its tributaries has been negatively impacted over the last 150 years. Increased water temperatures, decreased dissolved oxygen levels, and increased turbidity and contaminant loads have degraded the quality of the aquatic habitat for the rearing and migration of salmonids. The California Water Quality Control Board-Central Valley Regional (Regional Board) in its 1998 Clean Water Act §303(d) list characterized the Delta as an impaired waterbody having elevated levels of chlorpyrifos, DDT, diazinon, electrical conductivity, Group A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene), mercury, low dissolved oxygen (DO), organic enrichment, and unknown toxicities (Regional Board 1998, 2001). In general, water degradation or contamination can lead to either acute toxicity, resulting in death when toxic xenobiotic compound concentrations are sufficiently elevated, or more typically when concentrations are lower, to chronic or sublethal effects that reduce the physical health of the organism to survive over an extended period of time. Water quality also has effects on the composition of compounds deposited in the sediments of the region's waterbodies. When contaminants are present in the overlying water column, they eventually accumulate in the sediment (Ingersoll 1995) where they become available to fauna inhabiting the sediment. The concentration of toxic xenobiotic compounds in the sediment can eventually surpass the concentration of the compound in the overlying water column (EPA 1994) and impact the physiological and metabolic status of exposed organisms (Rand 1995; Goyer 1996).

Operations of the CVP and SWP pumps in the south Delta have significantly altered water flow patterns in the Delta. When exports are high, water is drawn into the southern portions of the Delta through the Delta Cross Channel, Georgiana Slough and Three Mile Slough from the mainstem of the Sacramento River. Likewise, water flow in the lower San Joaquin River can even be reversed and drawn towards the pumping facilities through the interconnected waterways of the South Delta. Fish are drawn with these altered flow patterns towards the pumping facility. These alterations in water flow have resulted in fish from both the Sacramento River and the San Joaquin River systems being drawn into the South Delta as a result of the water diversions. Lower survival rates are expected due to the longer migration routes, where fish are exposed to increased predation, higher water temperatures, more unscreened water diversions, degraded water quality, reduced availability of food resources, and entrainment into the CVP/SWP export facilities near Clifton Court Forebay in the south Delta (FWS 1990, 1992). Currently, the CVP/SWP pumping facilities are operated to avoid pumping large exports of water during critical migratory or life stage phases of listed fish. Real time monitoring of fish movements, and the development of more efficient fish screens have led to a decrease in the numbers of fish lost to the projects, but entrainment still accounts for significant losses to the listed fish populations. Herren and Kawasaki (2001) reported that the Delta region had 2,209 other diversions and Suisun Marsh had an additional 414, based upon their field observations. Of these diversions, 90% of those in the Delta measured between 12 and 24 inches in pipe inlet diameter, whereas those in Suisun Marsh were composed of 90 percent floodgates, with intake sizes between 36 and 48 inches. Only 0.7 percent of Delta diversions had screens on their intakes designed to protect fish from entrainment while only 2 percent of those in Suisun Marsh were similarly screened.

Invasive species greatly impact the growth and survival of juvenile salmonids in the Delta. Non-native predators such as striped bass, largemouth bass, and other sunfish species present an additional risk to the survival of juvenile salmonids migrating through the Delta that was not historically present prior to their introduction. These introduced species are often better suited to the changes that have occurred in the Delta habitat than are the native salmonids. The presence of the Asian clam (*Potamocorbula amurensis)* has led to alterations in the levels of phyto- and zooplankton found in water column samples taken in the Delta and Suisun Bay. This species of clam efficiently filters out and feeds upon a significant number of these planktonic organisms, thus reducing the populations of potential forage species for juvenile salmonids. Likewise, introductions of invasive plant species such as the water hyacinth (*Eichhornia crassipes*) and *Egeria densa* have diminished access of juvenile salmonids to critical habitat (Peter Moyle, University of California, Davis, personal communication, April 25, 2002). *Egeria densa* forms thick "walls" along the margins of channels in the Delta. This growth prevents the juvenile salmonids from accessing their preferred shallow water habitat along the channel's edge. In addition, the thick cover of *Egeria* provides excellent habitat for ambush predators, such as sunfish and bass, which can then prey on juvenile salmonids swimming along their margins. Water hyacinth creates dense floating mats that can impede river flows and alter the aquatic environment beneath the mats. Dissolved oxygen levels (DO) beneath the mats often drop below sustainable levels for fish due to the increased amount of decaying vegetative matter produced from the overlying mat. Like *Egeria,* water hyacinth is often associated with the margins of the Delta waterways in its initial colonization, but can eventually cover the entire channel if conditions permit. This level of infestation can produce barriers to salmonid migrations within the Delta.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR § 402.02).

A. Physical Habitat Alteration

Upland stream channels within the action area have been manipulated for agriculture and urban development. Riparian corridors have been removed to increase tillable acreage and to enhance flood water conveyance down the stream channel. The removal of the riparian canopy has increased solar heating of the channel, thus elevating summer water temperatures in many reaches beyond the thermal tolerance of salmonids. The removal of riparian woody plants has also eliminated recruitment of large woody debris into the stream channel, thus diminishing the complexity of habitat for fish dwelling in the effected watershed. The manipulation of the cross sectional area of the stream channel to minimize overbank flows during flooding events and the artificial straightening of the channel has led to many streams having an incised cross section, with the stream downcutting through the stream bottom under higher flows. These actions have led to a significant loss in both habitat complexity and variability within the impacted watersheds (Mount 1995). In addition, these changes in channel morphology have reduced the abundance of naturally functioning floodplains in the action area. In the current environmental state of the Delta, Suisun Bay, and their associated tributaries, juvenile salmonids have been found to use flooded bypasses, such as the Yolo Bypass, as a surrogate floodplain for refuge and off channel rearing (Sommer 2001).

Urbanization in several of the watersheds in Contra Costa, Solano, and Yolo counties within the project area have led to significant increases in the percent of impervious surface area. The recent increase in construction and development in these areas over the past few decades has resulted in more acres of land being covered by concrete or asphalt. This change in the permeability of the ground alters the local hydrology, increasing the surface flow of water entering stream channels after a rain event and causing a "flashiness" to the stream's hydrological cycle. Undeveloped areas have a slower and much more prolonged rise and fall of the water entering the watershed after a rain event, thus maintaining flow for a longer duration in the stream channel. This muted rise and fall in the stream's discharge volume attenuates scour associated with high runoff events, with their associated high current velocities (Mount 1995).

B. Water and Sediment Quality

Increased urbanization has led to a concurrent increase in contaminants in stormwater runoff leaving developed regions of the project area via storm drains. The increase in population within the Central Valley as a whole, and in particular within the Contra Costa County area, has led to an increase in the volume of sanitary wastewater effluent entering the Delta and Bay from waste water treatment plants. This form of effluent has recently been identified as a major source of contaminants of pharmaceutical origin, particularly of estrogen-like compounds derived from birth control pills. These compounds may have significant effects upon the reproductive capacity of exposed organisms.

C. Major Construction Projects

Within the Carquinez straits region of the project area, the California Department of Transportation (Caltrans) is in the process of constructing the new Benicia Bridge project. Part of this construction project entails pile driving several very large pilings into the underlying substrate for the bridge supports. The acoustic energy created by the pile driving process often exceeds the levels necessary for permanent damage, and even death, for many species of fish (approximately 180 dB, [ref 1 μpascal] or greater), including salmonids, found within close proximity of the pile-driving activity. The range of these adverse effects varies depending on tides, current velocities, water temperatures, and the frequency of the resonance from the pile. Additional pile driving activities in the strait at the Concord Naval Weapons Depot and the commercial shipping docks in Benicia also contribute to the acoustic environment of the waterway. These large projects have been consulted on by NOAA Fisheries, and reasonable and prudent measures incorporated into their project design to minimize or avoid the adverse effects of the pile driving activity, including work windows and bubble curtains to reduce the exposure of listed salmonids to the acoustic energy released by the pile driving process.

D. Habitat Restoration and Environmental Monitoring

Habitat restoration projects are occurring in Suisun Marsh and Peyton Slough (URS, 2002c). In general, habitat restoration projects are expected to increase habitat complexity or quality, and increase the growth and survival of rearing salmonids by creating conditions that increase the food supply or improve conditions for feeding and successful migration, and decrease the probability of predation.

V. EFFECTS OF THE ACTION

Pursuant to section 7(a)(2) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of the SFPP Concord to Sacramento Pipeline project on endangered Sacramento winter-run Chinook salmon and its critical habitat, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead and threatened Central California Coast steelhead. The SFPP Concord to Sacramento Pipeline project is likely to adversely affect listed species and critical habitat through exposure of fish to petroleum products arising from pipeline leaks over the life time of the pipeline. In the *Description of the Proposed Action* section of this Opinion, NOAA Fisheries provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NOAA Fisheries provided an overview of the threatened and endangered species and critical habitat that are likely to be adversely affected by the activity under consultation.

Regulations that implement section 7(b)(2) of the ESA require that biological opinions evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR 402.02). Section 7 of the ESA also requires biological opinions to determine if Federal actions would destroy or adversely modify the conservation value of critical habitat (16 U.S.C. §1536).

NOAA Fisheries generally approaches "jeopardy" analyses in a series of steps. First, NOAA Fisheries evaluates the available evidence to identify direct and indirect physical, chemical, and biotic effects of the proposed action on individual members of listed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to a species' environment - such as introducing exotic competitors or a sound). Once NOAA Fisheries has identified the effects of the action, the available evidence is evaluated to identify a species' probable response (including behavioral responses) to those effects to determine if those effects could reasonably be expected to reduce a species' reproduction, numbers, or distribution (for **example,** by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). The available evidence is then used to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

A. Approach to Assessment

1. Information Available for the Assessment

To conduct the assessment, NOAA Fisheries examined evidence from a variety of sources. Background information on the status of these species and critical habitat, and the effects of the proposed action on the species and its environment has been published in a number of documents including peer reviewed scientific journals, primary reference materials, governmental and non-governmental reports, and scientific meetings as well as the supporting information supplied with the action's environmental documents.

2. Assumptions Underlying This Assessment

In the absence of definitive data or conclusive evidence, NOAA Fisheries must make a logical series of assumptions to overcome the limits of the available information. These assumptions are made using sound, scientific reasoning that can be logically derived from the available information. The progression of the reasoning will be stated for each assumption, and supporting evidence cited.

B. Assessment

1. Construction impacts

Project construction is expected to take approximately eight months to complete *(i.e.,* March 2004 to October 2004). The applicant has stated that this period corresponds to the "dry season" for the project area. However, precipitation events are likely to occur beyond the March 1 starting date and thus streams within the action area are likely to still have surface flow within their channels until the heat of summer reduces or eliminates the in-channel flow. A more significant factor in determining the suitability of a stream with surface flow in harboring salmonids is the running average of the water temperature. Lethal water temperatures for salmonids are reached when they exceed approximately 24 °C for one week. The preferred seven day average daily mean temperature (7DADM) is less than 18 °C for salmonids (EPA 2003). Within the action area, these temperatures will be reached by the end of May in most of the smaller tributaries. Larger bodies of water, or those controlled by dam releases, may have cooler temperature regimes at this time of year (CDEC 2003). Therefore, the early part of the construction period *(i.e.,* March 1 to May 31) will overlap with a portion of the year when salmonids may be present in the waterbodies crossed by the proposed project. Furthermore, historical emigration data for the listed salmonids within the action area indicates that listed fish may still be migrating out of the Delta system and passing through the Carquinez Strait as late as June.

a. *Cross-Country ROW Clearing*

A 100-foot-wide ROW will be cleared along the pipeline alignment and all vegetation will be removed from the work zone. The denuding of the surface soils will elevate the risk of sedimentation of waterways along the pipeline alignment. Sedimentation can affect salmonids in several ways, including (1) avoidance and distribution, (2) reduced feeding and growth, (3) respiratory impairment, (4) reduced tolerance to disease and toxicants, and (5) physiological stress (Waters 1995). However, sedimentation from ROW clearing is not expected to adversely affect listed salmonids because of the primarily upland location and narrow width (100 feet) of the ROW, the transitory nature of the construction phase (eight months), the implementation of erosion control factors for both short-term (hay bales, buffer zones, etc.) and long-term (revegetation and recontouring) periods, and the ability of the waterway to flush itself of the temporary input of sediments from the construction phase.

b. *Cross-Country Trenching*

The trenches along the alignment typically will be six-feet-deep by three-feet-wide. Should precipitation occur during this construction phase, rain runoff will accumulate in the trenches, and be contained there. Overland erosion is anticipated to be contained by the BMPs selected to minimize this factor, including revegetation and restoration of the trench to preconstruction conditions, thereby maintaining sediment onsite and preventing its entry into adjacent watercourses.

Contaminated soils may be encountered during the trenching process, particularly in northern Contra Costa County *(i.e.,* the Rhodia property) where industrial activity has left polluted soils behind. Contaminated soils will be hauled off site and disposed of in an appropriate landfill if they are not permitted to be used as backfill onsite. Trenches also may permit horizontal movement of contaminated groundwater along the pipeline alignment in polluted sites. Trench plugs *(i.e.,* slurry walls) will be placed in trenches where these conditions exist to halt the lateral flow of groundwater along the alignment. Trenching is not expected to adversely affect listed salmonids because both eroded sediments and contaminants are expected to be sufficiently contained and kept out of surface waters by the BMPs described above.

c. *Waterway Crossings*

(1) *Open Cut.* An open cut trench would be excavated to allow the pipe to be placed approximately 5 feet below the bottom of the stream channel. Streams will not be dewatered with open cut trenching as pipes are pre-welded for the entire crossing length, coated, counterweighted, and then lowered into place. The open cut is then backfilled with spoils, the channel bottom returned to its original configuration, banks stabilized at the cut, and revegetated as necessary.

Construction of open cut waterway crossings generally is not expected to adversely affect listed salmonids. This is due in part to the waterways selected for open cut trenching, which have marginal habitat for salmonid rearing in wet conditions and are typically dry during the summer dry season, thus precluding the presence of salmonids in the crossing alignment during the construction phase. The only exception is Pacheco Creek, which is tidally-influenced at the point of the water crossing and should be considered as potential off-channel rearing habitat for outmigrating juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead from March 1 through May 31. Open cut trenching will have associated noise and movement from people and excavating equipment that may startle fish, and also will increase the suspended sediment load to the stream. Juvenile salmonids should be able to disperse away from the immediate area to avoid the physical disturbance, but may be injured by the temporary disruption of normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Injury is caused when disrupting these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss. Disruption of these behaviors may also result in the death of some individuals to increased predation if fish are disoriented or concentrated in areas with high predator densities. However, only a small portion of the respective ESUs is likely to be affected because of the transitory nature of the activity and single crossing of Pacheco Creek.

(2) ***Slick and Conventional Boring.*** Slick and conventional boring will be conducted at some canal and flood control channel crossings as well as some streams with narrow channel widths. The setback buffer for the excavation of the boring pits is at least 15 feet from the banks of the waterway channel. The bore is never anticipated to enter the live channel of the waterway and unlike the HDD method, the bore is not pressurized, therefore a frac-out is not likely. If the bore were to start leaking from the entry of water from the overlying stream channel, the surface water and drilling mud slurry would flow into the bore pits and not into the overlying stream.

Slick and conventional boring of crossings of Suisun Creek and Laurel Creek during March 1 through May 31 may adversely affect Central California Coast steelhead. Slick and conventional boring of the crossing of Peytonia Slough during March 1 through May 31 may adversely affect juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead. Some disturbance of the channel bottom may occur due to the vibrations associated with the boring process. As the bore is only five feet below the bottom of the channel, it can be expected that both mechanical vibration and acoustic impacts will occur in the substrate above the bore, increasing turbidity and noise levels in the overlying water column.

The project will be required to adhere to Regional Water Quality Control Board (Regional Board) water quality objectives for the Sacramento River Basin. These objectives require that project discharge cannot exceed 1 Nephelometric Turbidity Unit (NTU) when natural turbidity is between 0 and 5 NTUs, 20 percent of natural turbidity levels when natural turbidity is between 5 and 50 NTUs, 10 NTUs when natural turbidity is between 50 and 100 NTUs, or 10 percent when natural turbidity is greater than 100 NTUs. NTUs are an indicator of the amount of light that is scattered and absorbed by suspended particles.

Research has shown that suspended sediment and turbidity levels moderately elevated above natural background values can result in non-lethal detrimental effects to salmonids. Suspended sediment affects salmonids by decreasing reproductive success, reducing feeding success and growth, causing avoidance of rearing habitats, and disrupting migration cues (Bash *et al.* 2001). Sigler *et al.* (1984) in Bjornn and Reiser (1991), found that turbidities between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. Macdonald *et al.* (1991) found that the ability of salmon to find and capture food is impaired at turbidities from 25 to 70 NTUs. Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs. Increased sediment delivery can also fill interstitial substrate spaces and reduce cover for juvenile fish (Platts and Megahan 1975) and abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991). Turbidity should affect Chinook salmon and steelhead in much the same way that it affects other salmonids, because of similar physiological and life history requirements between species.

Newcombe and Jensen (1996) believe that impacts on fish populations exposed to episodes of high suspended sediment may vary depending on the circumstance of the event. They also believe that wild fish may be less susceptible to direct and indirect effects of localized suspended sediment and turbidity increases because they are free to move elsewhere in the system and avoid sediment related effects. They emphasize that the severity of effects on salmonids depends not only on sediment concentration, but also on duration of exposure and the sensitivity of the affected life stage.

Suspended sediment from construction activities would increase turbidity at the project site and could continue downstream. While some suspended sediment may derive from erosion along access routes and other disturbed ground, the majority is expected from in-water work activities such as cofferdam installation and removal. The nature of the activities would confine sediment and turbidity increases to the location of the disturbance activity and downstream for several hundred feet. Because of the localized nature of sediment and turbidity changes, only portions of the action area are expected to be impacted by any increase, while the remainder of the action area will be unaffected, thus limiting exposure to the fish that are in the pathway of the turbidity event and not affecting fish or the suitability of habitat that are not within the turbidity plume. Although Chinook salmon and steelhead are highly migratory and capable of moving freely throughout the action area, a sudden localized increase in turbidity may injure some juvenile salmonids by temporarily disrupting normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Injury is caused when disrupting these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss. Project-related turbidity increases may also affect the sheltering abilities of some juvenile salmon and steelhead and may contribute to their death by increasing their susceptibility to predation.

Increased levels of anthropogenic sound may damage the internal structures of fish ears. Recent studies by McCauley *et al.* (2003) indicated that fish exposed to intense levels of noise ($\geq$ 180 dB, re 1μPa) sustained extensive damage to their sensory epithelia that was apparent as ablated hair cells. The damage was regionally severe and chronic, as there was no indication of repair or replacement of the damaged sensory cells for up to 58 days after exposure. Fish exposed to lower intensity sound (142 dB, re 1μPa) experienced a decrease in their sensitivity to auditory stimulus, with hearing specialists more susceptible to the degradation in auditory response than hearing generalists *(i.e.,* salmonids; Scholik and Yan 2001, 2002). These studies however, did not permit the fish to escape the acoustic insult, while mobile fish should be able to flee the area and thus avoid injury. SFPP and the CSLC did not provide data indicating the level of ambient noise generated from the HDD and boring operations; however, noise and vibration during these forms of construction activities are evident, and personnel working with the machinery are required to wear hearing protection when on the job site (J. Stuart, NOAA Fisheries, personal observation). Noise generated by the boring equipment can be expected to be transferred through the ground to the water column in the channel by a process known as coupling (Burgess and Blackwell 2003), but the efficiency of transfer is unknown for this project. The sound pressure level (SPL) will decay with increasing distance from the source, and will eventually attenuate to insignificant levels.

Mobile aquatic organisms, such as salmonids, should be able to leave the area if the noise or vibration becomes too noxious for them. The incremental buildup in noise and vibration from the drilling activity as it approaches the stream channel should enable fish to vacate the construction area prior to suffering any permanent physical effects. Nevertheless, fish may be injured by the temporary disruption of normal behaviors that are essential to growth and survival (see *Open Cut,* above). However, NOAA Fisheries believes only a small portion of the various ESUs are likely to be affected because of the transitory nature of the drilling activity and the single crossings of Suisun Creek, Peytonia Slough, and Laurel Creek by the pipeline alignment.

(3) *HDD.* HDD has been selected for the most several waterways along the alignment that may contain listed salmonids, including Walnut/Grayson Creek, Cordelia Slough, Ledgewood Creek, Ulatis Creek, Putah Creek, and the toe sloughs of the Yolo Bypass. HDD is used in large-scale water-way crossings in which a fluid-filled pilot bore is drilled and then enlarged to the size required for the pipeline. A slurry of water and bentonite clay *(i.e.,* drilling mud) is used to aid the drilling and to coat the walls to maintain the bore opening. A wire line magnetic guidance system is used to ensure that the angle, depth, and exit point abide by the detailed engineering plans for the bore.

The main risk of the HDD methodology is the potential for uncontrolled returns of drilling mud through fractures in the bore's overlying geological substrate *(i.e., a* frac-out). The risk for a frac-out is greatest during the entrance and exit phases of the bore, when the drill head is boring through shallow soils in the upland portions of the drill alignment. The risk of a frac-out declines as the depth of the drill head increases, becoming minimal when the drill head is at depth under the channel of the waterbody. Bores are frequently ten to twenty meters or more beneath the channel bottom during this phase of the crossing. However, should the bore alignment transit an unconsolidated geological strata, or hit an obstruction, drilling mud may travel along this path of lowered resistance and exit at the surface, creating a frac-out. The potential for this occurrence is reduced by geological core sampling along the pipeline alignment to look for substrate anomalies or potential obstructions.

Bentonite is a very fine clay with positive and negative charges on its surfaces. These clay particles are attracted to oppositely charged surfaces, such as gill membranes, and adhere to them. This characteristic makes the bentonite particularly detrimental to aquatic organisms, like salmonids. Affected organisms may suffocate if exposed to high concentrations of the clay, overwhelming the animal's ability to clear the impacted gill filaments through physiological processes such as "coughing" or mucous secretion. Sub-lethal effects may include impairment of normal behaviors that are essential to growth and survival (see *Open Cut,* above).

The HDD portion of the construction program may adversely affect Central California Coast steelhead in Walnut/Grayson Creek and Ledgewood Creek; juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead in Cordelia Slough; and Central Valley steelhead in Ulatis and Putah Creeks from March 1 through May 31 because the activity will overlap with salmonid migration through the action area. These waterbodies represent only a small portion of the total rearing and migratory habitat for the listed salmonid ESUs. Therefore, the HDD actions are expected to expose only a small segment of the affected ESUs to the adverse effects of a frac-out. In the case of a frac-out, clean up protocols will include containment and vacuum removal methodologies which should adequately remove most spilled bentonite, thus reducing long-term effects.

The Yolo Bypass serves as an important rearing and migratory habitat for Sacramento River winter-run Chinook salmon, Central Valley Spring-run Chinook salmon and Central Valley steelhead during its periodic winter flood inundations. However, construction activities cannot occur within the Yolo Bypass until the Bypass has drained and soil conditions become dry enough to sustain trenching activities without risking wall collapse and excessive seepage. Thus, the HDD actions in the Yolo Bypass cannot take place until the Bypass is dry, and adverse effects to listed salmonids from possible frac-outs are not expected. Any residual bentonite from a frac-out in the Yolo Bypass left over following the cleanup activities could potentially expose fish at a later date, but the volume of water flowing through the Bypass when flooded would ameliorate the negative impacts associated with the material due to its extreme dilution.

d. *Cross-Country Construction, Clean up and Restoration*

Cross country construction will take place along the ROW corridor and restores the original ground contours, re-establishing the original surface drainage. This activity is not expected to adversely affect listed salmonids. The primary concern is sedimentation which should be controlled by the erosion BMPs incorporated into the project description.

2. Long Term Operational Impacts

These impacts are expected to occur during the fifty year life span of the pipeline at varying intervals of time.

a. *Operation and Maintenance of the Pipeline*

(1) *Pipeline Inspection and Repairs.* The pipeline will have internal inspections done by "pigging" every five years, and five ground inspections per year over the pipeline's approximate 70 mile alignment. Inspections via "pigging" are not expected to adversely affect listed salmonids because the inspections are internal to the pipeline and should not affect the aquatic environment in any foreseeable way. Visual inspections will be primarily terrestrial (some may be flown); however some aquatic crossings, such as the Carquinez Strait will need to be assessed. These inspections may employ SCUBA divers, or potentially remotely operated vessels (ROVs). The disturbance from divers or ROVs is expected to be minor, infrequent, and of short duration, and therefore is not expected to adversely affect listed salmonids.

Repairs to the pipeline will require excavation of the pipeline to expose the pipeline and to conduct the repairs. Should the pipe need to be repaired during the rainy season or in an aquatic habitat, adverse effects to listed salmonids may occur. The failure rate at any given section of the pipeline is expected to be infrequent (see Tables 2 and 3 [attached]). Take resulting from the repairs would most likely result from sedimentation or entrapment in the excavation/cofferdam installation process in an aquatic environment. Repairs occurring in the Carquinez Strait would require divers and barge mounted equipment. Such activities could adversely affect listed salmonids depending on the season of occurrence and the location and amount of work. In 1992, SFPP placed additional protective cover over the submerged 14-inch pipeline by placing 4-inch quarry rock with a clamshell dredge over the pipeline alignment. More recent surveys have indicated that the protective cover is again below the acceptable criteria required by the CSLC (CSLC 2003). SFPP assumes that it will use similar procedures to replace the protective rock cap over the pipeline. In addition to the physical disturbances which may startle fish, this technique creates a turbidity plume down-current of the work site. Within the Carquinez Strait, the turbidity plume could be created either east or west of the pipeline alignment depending on the tidal stage. Migratory salmonids passing through the strait during the rock placement activity would be exposed to the noise, movement, and turbidity plume caused by this activity. Since the pipeline crossing is at the narrowest section of the strait, exposure may be unavoidable. The startle response may impair normal behaviors that are essential to growth and survival (see *Open Cut,* above). The suspended sediments may impair fish respiration or feeding behavior or have elevated levels of contaminants that may cause adverse physiological effects.

NOAA Fisheries expects that only a small portion of the various ESUs is likely to be affected because the pipeline involves only a single crossing of all the waterways containing listed salmonids. Repairs occurring in the flooded Yolo Bypass and in the Carquinez Strait are expected to have greater impacts to listed salmonids at the ESU level than those occurring in tributaries due to the potential for more fish to be present. The flooded Yolo Bypass is a key rearing area for outmigrating juvenile Sacramento winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead from the Sacramento River and tributaries. Migrating adult and juvenile Sacramento winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and Central California Coast steelhead originating from Central Valley, Delta, and Suisun Bay tributaries all must pass through the Carquinez Strait.

(2) *Vegetation **Maintenance.*** Every 3 years vegetation growing within the ROW will be cut down and any trees or shrubs within 10 feet of the pipeline centerline will be removed. The relatively shallow approach of the pipeline at open trench cut and bored crossings may necessitate the loss of riparian growth along the alignment where the pipeline crosses stream channels. Such removal of vegetation may decrease shaded riverine aquatic (SRA) habitat along stream corridors and constitutes an adverse effect to listed salmonids; however it is not expected to cause harm because it would account for only 20 feet of stream bank on either side of each crossing. The HDD crossings are not anticipated to affect riparian vegetation as the pipeline will be approximately 30 feet below the stream bank at the water crossing, far enough below the soil

surface to avoid impacts from the root zone on the pipeline. Therefore, vegetation maintenance activities at HDD crossings are not expected to adversely affect listed salmonids.

b. *Accidental Spills and Ruptures*

The CSLC's Draft EIR conservatively estimated that at least one major spill or leak would occur from the pipeline over its fifty year life span *(i.e.,* once every 37 years). A major spill or rapture is considered to be one that is greater than 1,000 barrels. There are at least 64 water crossings for the proposed alignment, therefore it is very likely that a large spill would contaminate surface waters. Petroleum hydrocarbon products are known to be toxic to aquatic life, including salmonids, and would present a significant adverse effect to those organisms exposed. A large spill that enters surface waters, particularly in a major water crossing like the Carquinez strait or the flooded Yolo Bypass could result in the direct or delayed mortality of listed salmonids.

(1) *Causes of Spills or Ruptures.* The anticipated frequency of unintentional releases (incident rate) was determined for releases from the existing and proposed SFPP pipeline system. The incident rate presented in the Draft EIR (CSLC 2003) is intended to be the average incident rate, to be expected over a 50-year project life along the entire 70-mile proposed pipeline. Because the frequency of accidents increases as pipelines age, the actual incident rate will likely be somewhat less than the value presented during the early period of operation. During the latter years of operation, the rate will likely be somewhat higher. New technologies may become available that may reduce the risk in future years. The frequency of a major spill (> 1000 barrels) was predicted to occur 1.34 times during the 50 year life span of the pipeline, however smaller spills were predicted to occur much more frequently; >1 barrel 9.63 times during the 50 year period, and > 50 barrels 3.86 times during the same period. The accidental spill frequency rate for any one mile section of pipeline is significantly less than for the entire pipeline. Sections of pipeline that cross through aquatic habitats are no more likely to experience an accidental leak than upland sections of the pipeline and sensitive water crossings only account for approximately 9 % of the total pipeline distance. Furthermore, the sections of pipe used in the water crossings of the pipeline alignment are of greater wall thickness than upland sections (0.500 inches compared to 0.375 inches) thus giving increased protection from the loss of structural integrity in the pipe.

The project proponents, SFPP, contend that the spill rates cited by the draft EIR are very conservative estimates based on older data, and that with current materials and monitoring techniques the rate of failure resulting in a large spill (1000 barrels or more) is half that reported by the draft EIR. Spills resulting from external corrosion and third party incidents are expected to be even less likely. However, even if the 74-year frequency cited by the project proponent is used for the estimate, there is still sufficient cause for concern. Given recent pipeline failures in Bellingham, Washington, Phoenix, Arizona, and Martinez, California, there is a real concern for the occurrence of a large leak along the proposed pipeline sometime during its fifty-year lifespan. Alternatively, it is possible there may never be a large spill during the fifty-year lifespan of the pipeline, and therefore no adverse effects to listed salmonids.

The anticipated frequency of unintentional releases developed by the CSLC is based primarily on the 1981 through 1990 data collected for California's regulated interstate and intrastate hazardous liquid pipelines (California Hazardous Liquid Pipeline Risk Assessment 1994, as cited in the Draft EIR [CSLC 2003]). The report included a complete inventory of all 7,800 miles of interstate and intrastate hazardous liquid pipelines within the State. It also included an audit of all 514 unintentional releases that occurred within this 10-year period. Unintentional releases primarily resulted from one of five causes:

(I) *External Corrosion.* The California study found that the frequency of unintentional releases caused by external corrosion was 4.18 incidents per 1,000 mile-years. However, pipelines constructed in the 1950s had an external corrosion incident rate of 2.47 incidents per 1,000 mile-years; those constructed in the 1960s, 1970s and 1980s had external corrosion incident rates of 1.47, 1.24, and 0.00 incidents per 1,000 mile-years respectively. On the other hand, pipelines constructed before 1940 and those constructed during the 1940s, had external corrosion incident rates of 14.12 and 4.24 incidents per 1,000 years, respectively.

During the 1940s and 1950s, significant improvements were made in pipeline construction techniques. Relative to external corrosion, the primary improvements included advances in external coatings and more widespread use of these coatings and cathodic protection systems. These items account for the significant reduction in external corrosion incident rates over pipelines constructed prior to the 1940s. For newer pipelines, it is impossible to isolate the individual effects of pipe age and other improvements (e.g., technology, construction techniques, the more widespread use of high quality external coatings and cathodic protection systems).

The proposed system normally will be operated at ambient temperatures, using externally coated pipe, with an impressed current cathodic protection system; the anticipated frequency of external corrosion-caused unintentional releases will likely be approximately 2 incidents per 1,000 mile-years (CSLC 2003). This rate is slightly higher than both the data for pipelines constructed during the 1960s and the data for pipelines operated between 70 and 99 "F. The proposed frequency is intended to reflect the average value over a 50-year project life.

(ii) *Internal Corrosion.* A frequency of 0.19 incidents per 1,000 mile-years for unintentional releases caused by internal corrosion is consistent with the historical data in the California study. Although the actual internal corrosion-caused incident rate was found to be lower for refined petroleum product lines, the statistical analysis indicated that the pipe contents were not a factor. Operating temperature however was a factor. The proposed incident rate corresponds to an operating temperature of 97.9 °F, which is close to the pipeline design temperature.

(iii) *Third Party Damage.* The California study found that the overall frequency of third party damage-caused unintentional releases was 1.46 incidents per 1,000 mile-years. For pipelines constructed in the 1950s, the frequency was only 0.88 incidents per 1,000 mile-years; it was even lower for newer lines. These lower values resulted primarily from the increased awareness of the threat from third party damage to pipeline facilities; newer lines have benefitted from improved line marking, one-call dig alert systems, avoidance of high risk areas, improved documentation, increased depth of cover, and public awareness programs. The frequency of unintentional releases caused by third party damage for all volume releases from the proposed line is estimated to be approximately one incident per 1,000 mile-years (CSLC 2003).

(iv) *Mechanical Failures and Maintenance.* The estimated frequency of equipment malfunction-caused unintentional releases for the proposed pipeline is 0.37 incidents per 1,000 mile-years. This is consistent with the historical values of California study. Likewise, the California study estimates a frequency of improper maintenance-caused unintentional releases of 0.07 incidents per 1,000 mile-years.

(v) *Natural events — earthquakes, landslides, floods.* The frequency of these natural events are difficult to measure. Based on the California data, the frequency of unintentional releases caused by design flaw/error is 0.03 incidents per 1,000 mile-years. This would include pipelines that were placed in areas prone to floods, landslides, or earth movement from seismic activity that were inadequately designed for the potential stresses to the pipeline.

(2) *Categories of Unintentional Releases.* The draft EIR (CSLC 2003) divided the potential volumes of petroleum product spills into three categories: Complete pipeline rupture (8,400 barrels per hour [BPH]), Moderate pipeline releases (100 BPH) and small pipeline release (1 BPH). These categories of spills were analyzed and described as follows:

(I) *Pipeline Rupture (8,400 BPH).* This hazard involves a severance of the pipeline that is large enough to allow the entire throughput (8,400 BPH) to escape from the pipeline. Some of the most likely causes of a rupture would be complete pipe severance or a very large hole caused by a large excavator hitting the pipeline, pipe severance caused by landslide, pipe severance caused by exposed pipe within stream channels, or pipe over-pressure. For impact assessment purposes, it was assumed that the leak detection system would recognize this rupture in 1 minute; this is the fastest leak detection time provided by the Applicant, for leaks of approximately 11% of flow volume. It was also assumed that an additional five minutes would be required for the operator to analyze the data, initiate the response, stop the shipping pump, and close the MOVs. Using a maximum 8,400 BPH release flow rate and a total 6 minute time period yields an 840 barrel continued pumping release volume component for these ruptures.

Once the pipeline is shut down, the pipe contents would continue to be released at a gradually decreasing flow rate, until the line was drained from the raptured pipeline segment between the valves. This drain down release volume would depend on the location of the pipeline rapture relative to the adjacent isolation valves and pipeline elevation profile.

(ii) *Moderate Pipeline Releases (100 BPH).* Moderate pipeline releases most commonly result from third-party damage and material failures. Generally, these unintentional releases result in lower total releases volumes than pipeline raptures. Moderate pipeline releases and raptures are analyzed separately because their recurrence intervals are different.

In the analyses, a 100 BPH release rate would trigger the leak detection system alarm within 11 minutes. This is the leak detection time provided by the applicant for releases of approximately 1.2% of flow volume. An additional 10 minutes has been assumed for the operator to analyze the data, initiate the response, stop the shipping pump(s), and close the adjacent remotely actuated block valves. For a 100 BPH release flow rate, this would result in a 35 barrel continued pumping release volume component during this period.

For these moderate pipeline releases, portions of the line pack were assumed to drain from the release site, based on actual site conditions. Once block valves have been closed, a portion of the entire volume between adjacent block valves would drain from the release site, depending on the pipeline elevation profile, the location of any intermediate manual or check valves, and the remoteness of the release location. For the proposed pipeline, most of the manual block valves are relatively far from manned stations. It was assumed that two hours would be required for someone to arrive at the manual block valve to close it after a release had been detected. In addition, it was assumed that four hours would be required for the arrival of emergency response equipment. Once emergency response equipment arrives on site, it was assumed that any further release could be contained and/or recovered. Therefore, in the case of a 100 BPH release, the drain down volume of the release would be limited to volume lost in the four hours before emergency response equipment would arrive on-site *(i.e.,* 400 barrels).

(iii) *Small Pipeline Releases (1 BPH).* These releases are below the level that can be detected by the proposed leak detection system during pipeline operation. These relatively small pipeline releases are typically caused by external corrosion and may even occur in more than one location. Using this release rate, it is possible that 8,760 barrels would be lost in a year through small discrete perforations of the pipeline. Although the ongoing over-short accounting system normally would identify this loss in less than a year, it is possible that problematic shortages can go unidentified and/or unresolved for extended periods of time. For the worst-case release analyses, it was assumed that the accounting system or other measures would identify a release of this volume once the system volume imbalance reached 4,000 barrels (CSLC 2003).

(3) *Impacts of Petroleum Products to Aquatic Species and Habitats.* Gasoline is a mixture of petroleum hydrocarbons and other non-hydrocarbon chemical additives, such as alcohols and ethers. Diesel and jet fuel are middle distillates and may contain 500 individual compounds. Gasoline is more mobile than diesel or jet fuel due to the lower molecular weights of its components. The lower molecular weight results in lower viscosity, higher volatility, and moderate water solubility. Gasoline released to the environment contains high percentages of aromatic hydrocarbons, which are among the most soluble and toxic hydrocarbon compounds. Diesel and jet fuel tend to be heavier, less water soluble, and less mobile than gasoline. As a petroleum fuel moves through the aquatic environment, the fluid loses its lighter components and becomes more viscous, slightly denser, less volatile, and less mobile than fresh product, a process termed weathering. These characteristics influence the extent of contamination within a given period of time (diesel and jet fuel will travel more slowly than gasoline) the effectiveness of remediation (gasoline vaporizes more easily than diesel or jet fuel), and the toxicity of contamination (gasoline contains more toxic components) (Irwin 1997; FWS 1998b).

Spilled petroleum products can alter aquatic habitats by filling crevices, changing substrate characteristics and coating hard substrates. Organisms can be affected physically through smothering, interference with movements (especially benthic organisms), coating of external surfaces with black coloration (leading to increased solar heat gain), and fouling of insulating body coverings (birds and mammals). Toxicity can occur via absorption through the body surface (skin, gills, etc.) or via ingestion. Biological oxidation (through metabolism) can produce products more toxic than the original compounds (Rand 1995). Acute toxicity is unlikely for fish, especially after some weathering, in small spills. Sublethal effects include reduced reproductive success, narcosis, interference with movement, declines in the immune response, development of tumors and lesions and disruption of chemosensory function (i.e., similar to human smell or taste) (Rand 1995; FWS 1998b).

A product spill could enter aquatic habitats through direct entry, runoff from upland areas within the watershed (especially during storm runoff), and/or contamination of groundwater feeding streams. Direct entry of petroleum into dry stream channels would have no immediate direct impact on aquatic organisms. Petroleum remaining in the habitat would lose its toxicity through weathering, but could adversely affect organisms colonizing these areas during the wet season through physical and chemical alteration of the habitat. Impacts on dry stream channels are generally not expected to be significant, especially with the implementation of cleanup procedures. Cleanup by excavation to remove contaminated sediments, however, also could alter the affected habitats. For small spills requiring little disturbance of the habitat structure, impacts may not adversely affect listed salmonids. For spills that affect large areas of stream habitat, adverse affect could occur if bed and bank alteration resulting from contamination or cleanup activities reduces habitat quality. Impacts of habitat alteration during cleanup could be mitigated by implementation of minimal-impact cleanup techniques and restoration of habitat structure after cleanup is completed. In some instances, leaving the spilled petroleum product in the habitat may minimize impacts on aquatic resources.

Impacts of petroleum spills on resident biota may be short- to long-term, depending on the amount of product spilled, specific environmental conditions at the time, and containment and cleanup measures taken. There is the potential to introduce high concentrations of toxic materials, such as the water-soluble carcinogen, benzene, into the surface water. Areas where adverse impacts to listed salmonids could occur include, but are not limited to, the Carquinez Strait, Peyton Slough, Walnut Creek, Pacheco Creek, Suisun Marsh, Cordelia Slough/Creek, Ledgewood Creek, Peytonia Slough, Laurel Creek, Ulatis Creek, Putah Creek, Willow Slough, Yolo Bypass, and the Sacramento River Toe Drain. The probability of exposing listed salmonids to petroleum products from a spill depends upon the timing of fish migrations through the waterbodies listed above. Furthermore, the number of fish passing through the spill will determine the actual extent of the incidental take resulting from the spill incident, as will the residual effects upon the biota within the spill area *(i.e.,* forage base invertebrates) and the transferred effects to listed salmonid populations.

(4) *Environmental Fate of Petroleum Products in Aquatic Species and Habitats.* Once released into the environment, portions of the petroleum products may either evaporate into the air, leach into soils, or dissolve into water. Hydrocarbons that volatilize into the air are broken down by sunlight into smaller compounds via a process called photodegradation. Molecules with higher molecular weights are more susceptible to this process. Petroleum products released into an aquatic environment will have portions float to the surface, where photodegradation and volatilization of low molecular weight fractions can occur. Soluble fractions will dissolve into the water column, and some heavier fractions will sink to the bottom and cover the bottom sediments. In general, petroleum products are comprised mostly of lightweight hydrocarbons, that tend to float to the surface, evaporate, or dissolve in the water. A smaller proportion of the typical petrochemical product is comprised of heavier material that may sink to the bottom.

Spilled petroleum products will spread out from the source of the spill. The rate of the spreading is dependent on both intrinsic properties of the product itself and the extrinsic environmental conditions. Heavier molecular weight materials, such as crude oil, spreads rather slowly, at 100 to 300 meters per hour, whereas highly refined, low viscosity, low molecular weight products can spread up to 600 meters per hour. Water currents, winds, and tides are extrinsic environmental factors that can enhance the rate of the spill's spreading. Although the increase in the size of the surface area of the slick exposes a greater area to the effects of the hydrocarbons, it also enhances surface dependent fate processes such as evaporation, photodegradation, and dissolution.

Immediately after a spill, the microbial populations needed to metabolize and degrade the hydrocarbon constituents are not present in sufficient numbers to cope with the spill. The toxicity of the lightweight hydrocarbons may even preclude these microorganisms from becoming established, and biodegradation will be inhibited until these hydrocarbons have diminished via weathering *(i.e.,* evaporation and dissolution). As the appropriate microbes become established and multiply, biodegradation proceeds at an increasing rate. Hydrocarbons are metabolized by the microbes, which require sufficient oxygen and nutrients to sustain the metabolic process. In nutrient-poor or oxygen-depleted environments, the metabolic processes which degrade the hydrocarbons will be inhibited or even halted. Biodegradation of the hydrocarbons may also reduce the dissolved oxygen content of the water column if insufficient mixing is present, causing adverse secondary effects to aquatic organisms.

(5) ***Response of Salmonids to Petroleum Product Spills.*** Given the low likelihood of fish exposure based on spill frequencies and volumes, and spill response and containment methods, the level of impact is not expected to significantly reduce the numbers, reproduction, or distribution of the listed salmonid cohorts over the fifty year period. However, given that the numbers of salmonids likely affected is variable and based on spatial and temporal distributions, it is possible that a substantial number of fish could be lost during a large spill. For example, in

the event of a worst case scenario, where a large spill over 1000 barrels occurs in a sensitive spot *(i.e.,* the Carquinez Strait or the flooded Yolo Bypass) during the peak outmigration period for a particular ESU, mortality ofjuvenile listed salmonids would be expected.

Spilled petroleum products affect salmonids both directly and indirectly. Direct effects include physical coating of the fish's gill filaments (reduction in oxygen uptake efficiency), disruption of the absorptive function of the gastrointestinal tract, and toxicological effects which can cause sickness or death in exposed fish. Indirect effects are less conspicuous and may result from alterations in the forage base available to the salmonids, changes in nutrient cycling in the aquatic environment, physical changes in the habitat characteristics used by the fish *(e.g.,* shaded riverine habitat vegetation), and increased susceptibility to pathogens and parasites present in the environment. The magnitude of the adverse effects is dependent on several variables, including the location and timing of the spill, the volume of the spill, the chemical profile of the petroleum products in the spill, and the types of remediation used for the spill clean up.

The toxicity of petroleum products depends upon their composition and the relative percentage of the water soluble fraction (WSF), particularly the aromatic constituents. Rudolph *et al,* (2002) showed that juvenile rainbow trout *(O. mykiss)* exposed to WSF of 2-D diesel fuel had a significant induction of the mixed function oxidases (MFO) which include the p450 cytochromes and their associated enzymatic pathways. The exposure of the fish to varying concentrations of the WSF of the 2-D diesel fuel resulted in liver damage and the development of external and internal lesions. The degree of effects surprisingly was more highly correlated with the duration of the exposure rather than the concentration of the exposure.

The less soluble compounds of petroleum products are more likely to be environmentally persistent, and associated with organic particulate matter or sediment. Compounds like Poly Aromatic Hydrocarbons (PAHs) are well known mutagens, carcinogens, and teratogens (Di Guilo *et al.* 1995, Rand 1995) that can form toxic metabolites when activated through the p450 metabolic pathways. Metabolism of PAHs create intermediate metabolites that can covalently bind with nucleic acid bases and form adducts to the bases. These adducts prevent the proper transcription and translation of the genetic material if not repaired by the host's internal repair mechanisms. Altered DNA sequences can be manifested in several different types of further genetic expression; point mutations, codon frame shifts in translation of RNA, and promotion of genes, such as oncogenes, that were previously unexpressed in the genome.

Exposure to PAHs and other aromatic compounds typical of petroleum hydrocarbon contamination from industry and spills were shown to suppress immune responses in fall-ran Chinook salmon *(O. tshawytscha)* in the Northwest region by Varanasi *et. al,* (1993) and Arkoosh *et. al,* (1998, 2001). This research indicated a high correlation between exposure to sediments, which contained elevated levels of aromatic and chlorinated organic compounds indicative of contaminants found in urban estuaries, and reductions in the primary and secondary humoral immune responses of juvenile Chinook salmon. The 1998 study indicated that this response resulted from both direct exposures and through the diets of the fish sampled from the estuaries, which fed upon organisms that dwelt in the sediments. Significant concentrations of these organic contaminants were bioaccumulated by the juvenile Chinook salmon during their relatively short residence time in the estuary. The followup study in 2001 exposed the marine adapted smolts of Chinook salmon to the aromatic and chlorinated organic compounds extracted from contaminated sediments through intraperitoneal injections and then measured their response to the marine bacterial pathogen, *Vibrio anguillarum.* The exposed fish suffered significantly higher pathogen-related mortality than the control fish. These results further indicated that although the exposure of juvenile fish migrating through the estuary is relatively short in duration, the immunosuppression may extend into their early ocean life, thus potentially influencing recruitment to adult stages later on.

(6) *Impacts of Cleanup Procedure.*

(I) *Disturbance to the Environment.* The environmental effects that would result from the cleanup strategies would depend on the response strategy of the cleanup. For example, residual contamination of soil and vegetation would more than likely remain after the proposed response to a wetland or small creek spill *(see Description of the Proposed Action)* in which a certain amount of product is acknowledged to "hang up" on these surfaces. Efforts to clean up these remaining fractions may destroy habitat as a result of the methods used. Grading of soils to remove the uppermost contaminated layers can disrupt and damage critical microbial populations needed for nutrient cycling in the marsh habitat (Mitsch and Gosselink 1993). Likewise, the use of heavy equipment in moist soils and shallow waters can compact the underlying soils, crashing invertebrates in their burrows and increasing water turbidity and downstream sedimentation. Furthermore, the manual cleaning of oiled vegetation and substrates with low and high pressure water hoses can disrupt and damage these sensitive habitats, uprooting vegetation and creating sediment plumes. The environmental cost of clean up activities should be balanced with the damage done to the habitat from the spill. As a result of the June 10, 1999, Olympic Pipeline Company spill in Bellingham, Washington, 5,500 barrels of unleaded gasoline flowed into Whatcom Creek, and ignited. The resulting fire and contamination killed three humans and over 100,000 fish, including many listed salmonids, as well as destroying 2.4 km of riparian forest and vegetation. The managing agencies decided that the habitat was so devastated, that the cleanup and remediation process required drastic measures to restore the environment back to an inhabitable condition. In this instance, removal of soil and gravel, channel bottom substrate cleaning, removal of contaminated large woody debris and its replacement, and reforestation programs were necessary to remediate the damage done by the spill (Helton and Doty 2003, Mauseth *et al* 2003). Such a large and devastating spill in a relatively small area necessitated the extraordinary cleanup strategy. Conversely, small spills may best be addressed by cleanup strategies that exercise moderation in their intensity and disturbance to the habitat.

(ii) *Residual Contamination.* As the product weathers through evaporation, microbial degradation, and other natural factors, the more volatile, acutely toxic fractions will be removed from the contaminant pool. However, as mentioned above, the heavier and more resistant fractions will remain. These products will then be bioavailable to organisms dwelling in, or feeding upon, the contaminated material and hence available to listed salmonids who may consume these organisms.

Responses of subtidal habitat in Prince William Sound, Alaska, following the Exxon Valdez tanker spill of crude oil in March of 1989 indicate that it can take several years for the habitat to recover. Subtidal fish communities required two or more years for species diversity and density to recover within contaminated sites (Barber *et al* 1995). Pink salmon *(O. gorbuscha)* spawning in intertidal streams did not fully recover until 1994, displaying elevated egg and fry mortality in oiled reaches of these streams until then (Murphy *et al* 1999).

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to section 7 of the ESA.

Cumulative effects include ongoing point and non-point storm water and irrigation discharges related to agricultural and urban activities. These discharges contain numerous pesticides and herbicides that may adversely affect salmonid reproductive success and survival rates. Agricultural practices in the Delta, and Solano and Yolo Counties may reduce riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into the Delta. Unscreened agricultural diversions throughout the Delta and Suisun Marsh entrain all life stages of listed fish. Grazing activities from dairy and cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters in the action area.

The Delta and Suisun Bay regions, which includes portions of Contra Costa, Alameda, Sacramento, San Joaquin, Solano, Stanislaus and Yolo counties, are expected to increase their populations by nearly 3 million people by the year 2020 (California Commercial, Industrial and Residential Real Estate Services Directory 2002). Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns.

Increased urbanization is expected to result in increased wave action and prop wash in the Sacramento River, the Delta, and Suisun Bay due to increased boating activity. This potentially will degrade riparian and wetland habitat by eroding channel banks, thereby causing an increase in siltation and turbidity. Wakes and prop wash also churn up benthic sediments thereby potentially resuspending contaminated sediments and degrading areas of submerged vegetation. This in turn would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids. Increased boat operation in the Delta will likely also result in more contamination from the operation of engines on powered craft entering the water bodies of the Delta.

VII. INTEGRATION AND SYNTHESIS

The degree to which Sacramento River winter-ran Chinook salmon, Central Valley spring-ran Chinook salmon, Central Valley steelhead, and Central California Coast steelhead may be impacted by the SFPP Concord to Sacramento Petroleum Products Pipeline project is a function of their presence within the action area. The proposed period of construction for the pipeline is from March 2004 through October 2004, which will overlap with more than half of the migration periods for all four listed ESUs. The period of greatest overlap with the presence of listed salmonids in the Delta and Suisun Bay and their tributaries is during the higher flow periods of winter and spring (*i.e.*, from March 1 through May 31).

Based on the foregoing analysis, NOAA Fisheries anticipates that some activities associated with the construction phase of the proposed project may adversely affect listed salmonids, but is likely to result in only a small amount of lethal incidental take due to the following reasons:

i. The June 1 through October 31 portion of the work window for the construction phase coincides with the summer-fall dry season. Aquatic habitat at the water crossings should either be dry or inhospitable due to elevated water temperatures during this period, and thus listed salmonids are not expected to be present within the project area during this later portion of the construction phase. However, the potential for incidental take of listed salmonids is possible during the earlier portion of the applicant's work window (March 1 through May 31).

ii. The use of HDD or slick and conventional bore techniques for larger water crossings will avoid in-water work, thus further minimizing impacts to the aquatic habitat and any salmonids that might be present. Some temporary degradation of the aquatic habitat may occur due to a frac-out incident using the HDD technique, but mitigation and remediation protocols should attenuate the extent of the adverse effects. Most adverse effects of construction activities to listed salmonids will be behavioral, which may not result in mortality.

iii. Construction of stream crossings are expected to affect only a small number of listed salmonids because of the transitory nature of the activity and single crossing of streams that contain listed salmonids.

iv. Implementation of construction BMPs to avoid or minimize adverse effects to listed salmonids, including erosion and sedimentation controls, will occur along the pipeline alignment.

v. By utilizing the existing 14-inch pipeline under the Carquinez Strait rather than installing a new pipeline in this key area, which is designated critical habitat for Sacramento River winter-ran Chinook salmon, the project avoids new impacts to listed salmonids resulting from construction activities.

The long term operation of the pipeline is predicted to last at least 50 years. During this period, some maintenance activities will occur that may adversely affect listed salmonids. Also, the CSLC has predicted that at least one major spill and several smaller ones will occur somewhere along the 70 mile length of the pipeline. The potential for a spill to occur at any one particular mile section of pipeline is approximately 0.0143 that of the entire pipeline (1/70). NOAA Fisheries believes that the long-term operation of the pipeline may adversely affect listed salmonids due to the potential for unintentional spills or raptures of the pipeline during the 50-year operational life time of the project. This conclusion derives in part from the following spill frequency estimates provided in the draft EIR from the CSLC:

Size of Spill From Pipeline in Barrels (gallons)	Frequency of Spill Recurrence over Entire 70-mile Pipeline (Years)	Frequency of Spill Recurrence over any 1-mile Section of Pipe (Years)
1. ≥ 1 barrel (42 gallons)	5	363
2. ≥ 50 Barrels (2100 gallons)	13	907
3. ≥ 100 barrels (4,200gallons)	17	1199
4. ≥ 1000 barrels (42,000)	37	2607
5. ≥ 5,000 barrels (210,000)	106	7413

Therefore, spills of up to 1000 barrels or more are expected somewhere along the pipeline alignment during the life time of the pipeline, and it is reasonable to assume that some spilled petroleum products will reach waters containing listed salmonids. The impact of these spills to listed salmonids is impossible to quantify due to the numerous variables associated with the risk assessment. Should the spill occur in an upland area away from water courses crossed by the pipeline alignment, then the effect to salmonids may be zero. If the spill occurred in the flooded Yolo Bypass during the time Sacramento River winter-ran Chinook salmon were present and rearing, adverse effects including mortality of listed salmonids would be expected due to the toxicity of the hydrocarbon products transported in the pipeline (gasoline, diesel fuel, and jet fuel). Based on the information provided by the applicant and the CSLC, there are no apparent differences between the rates of accidental spills occurring in upland areas versus those occurring in an aquatic habitat. Furthermore, cleanup methodologies, downstream effects, and lingering residual contamination may adversely affect additional fish beyond the initial temporal and spatial point of the spill.

Even though the spill event will lead to adverse effects upon listed salmonids that are exposed to the toxic petroleum compounds or residual cleanup efforts, the relatively infrequent occurrence of spills for any one mile section of pipeline in conjunction with the low proportion of sensitive aquatic habitats for listed salmonids along the pipeline alignment (i.e., approximately 8.9% of the 70-mile total length), indicate that the level of impact is not expected to significantly reduce the overall numbers, reproductive capacity, or distribution of the listed salmonid cohorts over the fifty year period. Only a small segment of each listed salmonid ESU is expected to be actually exposed to concentrations of petroleum products sufficiently elevated to have a lethal impact on individual fish. Duration of exposure is expected to be brief due to fish mobility within the spill site, chemical dispersal by wind and currents and dilution effects especially in large waterways such as the Carquinez Strait and Yolo Bypass. The depth of water in the impacted waterbody will also provide a measure of protection as lighter petroleum products will tend to float to the surface, leaving fish an escape corridor from the spill in deeper waters under the spill. Effects of primary concern are sublethal, as only a small percentage of fish are likely to be directly killed by the initial contaminant concentrations due to the relatively rapid evaporation of the lower weight components of the petroleum products. Sublethal effects such as behavioral changes *(e.g.,* swimming, feeding, attraction-avoidance, and predator-prey interactions), physiological changes *(e.g.,* growth, reproduction, and development), biochemical changes *(e.g.,* blood enzyme and ion levels), and histological changes *(e.g.,* degenerative necrosis of the liver, kidneys, and gill lamellae) are expected in the fish that are exposed to areas of elevated petroleum product concentrations.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead, the environmental baseline, the effects of the proposed SFPP Concord to Sacramento Petroleum Products Pipeline project, and the cumulative effects, it is NOAA Fisheries' biological opinion that the SFPP Concord to Sacramento Petroleum Products Pipeline project, as proposed, is not likely to jeopardize the continued existence of the above listed species or result in the destruction or adverse modification of the designated critical habitat for Sacramento River winter-ran Chinook salmon.

Notwithstanding this conclusion, NOAA Fisheries anticipates that some activities associated with this project may result in the incidental take of these species. Therefore, an incidental take statement is included with this Biological Opinion for these actions.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NOAA Fisheries as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered in this Incidental Take Statement. If the Corps: (1) fails to assume and implement the terms and conditions of the Incidental Take Statement, and/or (2) fails to require the SFPP to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and the applicant must report the progress of the action and its impact on the species to NOAA Fisheries as specified in this Incidental Take Statement (50 CFR § 402.14 (I)(3)).

This Incidental Take Statement is applicable to the operations of the SFPP Concord to Sacramento Petroleum Products Pipeline project as described in the Draft EIR (June 2003; CSLC 2003), SFPP Concord to Sacramento Petroleum Products Pipeline project BA (October 18, 2002; URS 2002b) and the SFPP Concord to Sacramento Petroleum Products Pipeline project JARPA (October 18, 2002; URS 2002a). All construction and operational activities as described in the project description for the program will be subject to this incidental take coverage as stipulated under the terms of section 7(b)(4) and section 7(o)(2) of the ESA. The construction phase will have incidental take coverage for the eight month period described in the project description. The operational life span of the pipeline will have incidental take coverage for normal maintenance and repair activities providing that the safety response elements described in the Draft EIR, Integrated Contingency Plan and the terms and conditions of this biological opinion are implemented. No incidental take coverage is provided for any spills of petroleum products. The incidental take exemption provided by this biological opinion will terminate following the retirement of the pipeline.

A. Amount or Extent of Take

1. Project Construction

No incidental take of adult Sacramento River winter-run Chinook salmon or adult Central Valley spring-run Chinook salmon from construction of the proposed SFPP Concord to Sacramento

Petroleum Products Pipeline project is anticipated. No incidental take ofjuvenile Sacramento River winter-run Chinook salmon, juvenile Central Valley spring-run Chinook salmon, Central Valley steelhead, or Central California Coast steelhead from project construction is anticipated from June 1 through October 31, 2004. NOAA Fisheries anticipates that construction of the proposed project may result in the incidental take ofjuvenile Sacramento River winter-ran Chinook salmon, juvenile Central Valley spring-ran Chinook salmon, Central Valley steelhead, and Central California Coast steelhead during the period from March 1 through May 31, 2004. Incidental take is expected to be in the form of harassment and harm from noise, vibration, turbidity, and sedimentation caused by project construction activities. These activities may induce behavioral changes, including habitat avoidance, that may result in death.

NOAA Fisheries cannot, using the best available information, quantify the anticipated incidental take of individual Chinook salmon and steelhead from project construction because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use of the project area. However, it is possible to describe the conditions that will lead to the take. In general, take from project construction is not expected to exceed that associated with the construction, between March 1 and May 31, 2004, of one open cut pipeline crossing of Pacheco Creek; one slick and conventional bore pipeline crossing of each of Suisun Creek, Peytonia Slough, and Laurel Creek; and one HDD pipeline crossing of each of Walnut/Grayson Creek, Cordelia Slough, Ledgewood Creek, Ulatis Creek, and Putah Creek. Specifically, turbidity is not expected to exceed the Regional Board water quality objectives for the Sacramento River Basin; the duration of turbidity, noise, and vibration impacts is not expected to exceed 10 days per crossing; and in-water frac-outs are limited to one occurrence, at which time drilling will immediately cease and the applicant will implement the HDD contingency plan, including coordination with NOAA Fisheries and review of the drilling operations.

2. Project Operation

No incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, or Central California Coast steelhead from project maintenance activities is anticipated from June 1 through October 31. NOAA Fisheries anticipates that some pipeline maintenance activities may result in the incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-ran Chinook salmon, Central Valley steelhead, and Central California Coast steelhead during the period from November 1 through May 31. Incidental take is expected to be in the form of mortality, injury, harassment, and harm from maintenance activities involving pipeline excavation, cofferdam construction and operation, and pipeline stabilization *(e.g.,* with quarry rock).

NOAA Fisheries cannot, using the best available information, quantify the anticipated incidental take of individual Chinook salmon and steelhead from project maintenance because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use of the project area.

However, it is possible to describe the conditions that will lead to the take. In general, take is not expected to exceed that associated with the maintenance, between November 1 and May 31, of the pipeline crossings (including the riparian zone) of Walnut/Grayson Creek, Pacheco Creek, Peyton Slough, Carquinez Strait, Cordelia Slough, Suisun Creek, Ledgewood Creek, Peytonia Slough, Laurel Creek, Ulatis Creek, Putah Creek, and the Yolo Bypass. The specific amount and extent of take that is anticipated from these activities will be quantified when specific activities are identified (see *Term and Condition 1(f)*, below)

NOAA Fisheries believes that take of listed salmonids may occur as a result of accidental petroleum product spills during the operational lifetime of the SFPP Concord to Sacramento Petroleum Products Pipeline project. Although these spills are fully anticipated to occur, they are not considered to be normal operational activities, and if they affect waterways they will constitute violations of the Federal Clean Water Act and State of California Porter-Cologne Water Quality Control Act, and therefore are illegal discharges. Therefore, NOAA Fisheries cannot provide incidental take exemption for accidental petroleum product spills.

Anticipated incidental take may be exceeded if project activities exceed the criteria described above; if the project is not implemented as described in the Draft EIR (June 2003; CSLC 2003), SFPP Concord to Sacramento Petroleum Products Pipeline project BA (October 18, 2002; URS 2002b), and the SFPP Concord to Sacramento Petroleum Products Pipeline project JARPA (October 18, 2002; URS 2002a); if the proposed conservation measures listed in the *Description of the Proposed Action* section are not implemented; or if the project is not implemented in compliance with the terms and conditions of this incidental take statement.

B. Effect of the Take

In the accompanying biological opinion, NOAA Fisheries determined that the level of anticipated take is not likely to result in jeopardy to the Sacramento River winter-ran Chinook salmon, Central Valley spring-ran Chinook salmon, Central Valley steelhead, or Central California Coast steelhead ESUs, or in the destruction or adverse modification of critical habitat for the Sacramento River winter-run Chinook salmon.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Sacramento River winter-ran Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and Central California steelhead.

1. Measures shall be taken to avoid or minimize impacts to listed salmonids and their habitat during construction of the pipeline, inspection of the pipeline, and routine maintenance and repair of the pipeline.

2. Measures shall be taken to avoid or minimize impacts to listed salmonids and their habitat from accidental spills of petroleum products from the pipeline during its fifty year operational lifetime.

D. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the USDA-ARS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Measures shall be taken to avoid or minimize impacts to listed salmonids and their habitat during construction of the pipeline, inspection of the pipeline, and routine maintenance and repair of the pipeline.

   a. The Corps and SFPP shall ensure that BMPs are employed during construction to ensure disturbance to river banks and stream channels are minimized to the maximum extent possible including, but not limited to, the BMPs described in the draft EIR.

   b. Initiation of water crossing construction by open cut, slick and conventional boring, or HDD shall not occur until after May 31, or until the ambient water temperature has exceeded 24 °C for at least one week. Construction can start on March 1 if the waterbody has no salmonid habitat present or if there is no anadromous access to it.

   c. The Corps and SFPP will develop a detailed HDD frac-out contingency plan prior to the initiation of construction activities.

      i. At least 30 days prior to the initiation of construction, SFPP will submit a detailed HDD frac-out contingency plan to the Sacramento Area Office of NOAA Fisheries for review and approval at the address given in subsection 2b (iv) below.

      ii. The frac-out contingency plan should address the procedures that will be followed in the event of a frac-out. Procedures for shutting down drilling operations, containment of the spill, clean up of the spill, stabilization of the frac-out, and the resumption of drilling, if warranted, must be explained thoroughly. An abandonment plan for the bore must be developed in the event the frac-out cannot be stabilized and sealed and drilling cannot be resumed at the original bore site.

   d. Riparian vegetation will be restored along the banks of water crossings at a 3 to 1 ratio to ensure that the eventual mature coverage replaces that which was lost. Trees in excess of four inches in diameter at breast height (DBH) will be replaced in kind within the riparian corridor at water crossing sites.

e. Additional pipeline monitoring measures shall be implemented at all water crossings.

i. All hydric soils and water crossings will have increased corrosion monitoring by one of the following methods:
   (1) Increased "smart pig" monitoring of the pipeline.
   (2) Use of buried corrosion monitoring devices to measure ambient soil corrosiveness.
   (3) Increased inspection of cathodic protection within the water crossing segments

ii. Measurements of pipeline integrity by pressure retention competency will be conducted at least annually in all water crossing segments.

iii. High visibility markers shall be placed every 200 meters along the pipeline alignment in the Yolo bypass, with enough elevation to be seen during bypass flooding conditions.

iv. Markers shall be placed at any juncture points and course changes along the pipeline alignment to indicate the changes in direction for the buried pipeline.

f. At least 30 days prior to the initiation of maintenance activities involving pipeline excavation, cofferdam construction, or pipeline stabilization in waterways containing salmonid habitat and that will occur during the period from November 1 through May 31, SFPP will submit a description of the proposed work to the Sacramento Area Office of NOAA Fisheries for review and approval at the address given in subsection 2a (iv) below. The specific amount and extent of take that is anticipated from these activities will be quantified at that time.

g. The Corps and SFPP will develop and initiate a monitoring plan for listed salmonids that may be affected by the short-term and long-term phases of the project.

i. The Corps, SFPP personnel, or their agents will record the date, location and circumstances surrounding the recovery of any dead or moribund salmonid bodies found in waterbodies crossed by the alignment of the pipeline (within 0.5 miles upstream and downstream of the crossing). Carcasses of recovered salmonids will be placed in a clean zip-loc bag, referenced with a unique identification number and placed immediately on ice in a cooler. Carcasses of recovered salmonids will be picked up by NOAA Fisheries agents following notification. The Sacramento Area Office of NOAA Fisheries will be notified within 24 hours at the phone and Fax numbers given in subsection 2b (iv) below of the recovery of any salmonid carcasses.

ii The Corps, SFPP personnel, or their agents will record any unusual behavior of fish or wildlife along the pipeline alignment during their routine inspections. Any occurrences of unusual behavior will be reported within 24 hours to Sacramento Area Office of NOAA Fisheries at the phone and Fax numbers given in subsection 2b (iv) below. Such behaviors for fish may include erratic swimming, gasping at the surface of the water, or failure to maintain equilibrium in the water column (see Appendix A).

2. Measures shall be taken to avoid or minimize impacts to listed salmonids and their habitat from accidental spills of petroleum products from the pipeline during its fifty year operational lifetime.

a. NOAA Fisheries shall be notified of petrochemical spills along the pipeline alignment that may adversely affect listed salmonids.

i. All spills that exceed 10 barrels (420 gallons) shall be reported to the Sacramento Area Office of NOAA Fisheries within 24 hours.

ii. Any spill within 50 meters of a watercourse shall be reported to the Sacramento Area Office of NOAA Fisheries within 24 hours, regardless of volume.

iii. Notifications of spills will include the date of the spill, location of the spill with GPS coordinates, volume of spill, and clean up procedures undertaken.

iv. Spill notifications will be sent to the Sacramento Area Office of NOAA Fisheries within 24 hours of the incident via phone/Fax followed by a hardcopy confirmation of the details. Notices may be sent to the following phone numbers and mailing address:

Attn: Supervisor
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706
Office Phone Number: (916) 930-3601
Fax Phone Number: (916) 930-3629

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(l) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of pertinent information.

1. The Corps and SFPP should promote the conservation measures specified in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan as they pertain to project activities in the project area through worker education, community programs, and research support.
2. The Corps and SFPP should support and promote aquatic and riparian habitat restoration within the Delta region, and encourage practices that avoid or minimize negative impacts to salmon and steelhead.

3. The Corps and SFPP should support anadromous salmonid monitoring programs throughout the Sacramento-San Joaquin Delta and Suisun Bay to improve the understanding of migration and habitat utilization by salmonids in this region.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of any conservation recommendations.

XL REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the May 16, 2003 request for consultation received from the Corps. This biological opinion is valid for the SFPP Concord to Sacramento Petroleum Products Pipeline project described in the DEIR and the BA received by NOAA Fisheries. As provided for in 50 CFR§402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in any incidental take statement is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an affect to the listed species that was not considered in the biological opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Table 1. Water Crossings Along Proposed Pipeline Route

Crossing Number	Description	Begin Milepost	Crossing Length		
			HDD	Bore	Open Cut
1	Walnut/Grayson Creek	0.3	1,125	--	--
2	Pacheco Creek	1.6	–	–	150
3	Peyton Slough (future align)	4.0	1,280	--	--
4	Carquinez Strait	4.8	–	–	--
5	Sulphur Springs Creek	6.8	800	--	--
6	Stream/Railroad	7.4	--	60	--
7	Stream/drainage outfall	9.1	--	--	25
8	Stream	9.8	–	–	25
9	Stream	10.6	--	--	25
10	Stream/drainage outfall	12.1	--	--	25
11	Stream	13.8	–	–	25
12	Stream	13.9	–	–	25
13	Stream	14.2	–	–	25
14	Stream	15.2	–	–	25
15	Stream	15.5	–	–	25
16	Stream	15.9	–		25
17	Stream	16.5	–	50	
18	Stream	17.1	–		25
19	Stream	17.5	–	100	
20	Stream	18.4	–	100	–
21	Cordelia Slough	19.2	800	–	–
22	Stream	19.5		200	–
23	Stream	20.3	–		25
24	Suisun Creek	20.5	–	250	
25	Drainage ditch	21.7	–	50	–
26	Stream/drainage ditch	22.9			25
27	Ledgewood Creek	23.3	800	–	–
28	Stream	23.6		–	25
29	Peytonia Slough	23.7	–	100	
30	Stream/railroad	24.8	–	320	–
31	Laurel Creek	26.1	–	60	–
32	Flood control culvert	26.3	–	200	–
33	Stream/Drainage Outfall	27.9	–	–	50
34	Stream	32.0	–	50	–
35	Irrigation canal	32.7	–	40	
36	Irrigation canal	33.8		40	–
37	Stream	35.2	–	80	–
38	Irrigation canal	36.7	–	40	–
39	Irrigation canal	38.8	–	40	–
40	Ulatis Creek	40.7	800		–
41	Maine Prairie Creek	41.9	–	100	–
42	Irrigation canal	42.2		80	
43	Hass Slough	42.8	1,000		–
44	Irrigation canal	43.7	--	80	–
45	Stream	44.8		120	–
46	Stream/drainage ditch	45.3	–	120	–
47	Stream	45.8		100	
48	Irrigation canal	46.5	–	50	--
49	Irrigation canal	46.6	–	50	
50	Irrigation canal	48.2	–	50	–
51	Irrigation canal	48.2	–	50	--
52	Stream/drainage ditch	50.3	–	80	--
53	Stream	51.0	–	80	–
54	Stream	51.2		100	–
55	Stream	52.7		80	--
56	Stream	53.3	--	150	–
57	Stream	53.9	--	80	–
58	Stream	54.1		100	--
59	Putah Creek	57.8	800		--
60	Canal	59.7	800		
61	Canal	60.5		100	--
62	West Yolo Bypass	62.0	800	--	
63	East Yolo Bypass	65.2	800		--
64	Washington Lake	65.8	800	–	–
	Footage Totals		10,605	3,350	550

Table 2 Anticipated Unintentional Releases from Proposed New **70-Mile, 20-Inch-Diameter** SFPP Pipeline

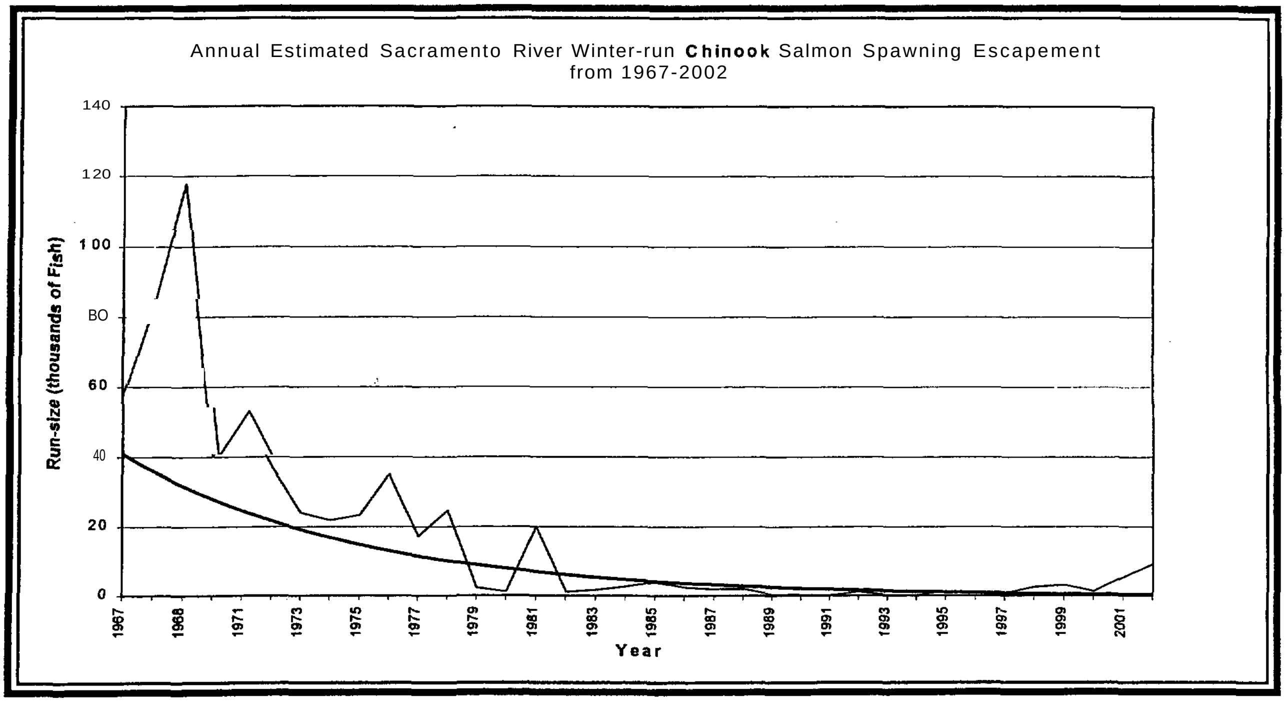
Unintentional Release Cause	Incident Rate (per 1,000 mile-years)	Pipeline Section Length (miles)	Unintentional Releases per Year	Anticipated Unintentional Releases Over **50-Year** Project Life
External corrosion	1.00	70	0.0700	3.5
Internal corrosion	0.19	70	0.0133	0.7
3rd party - construction	0.40	70	0.0280	1.4
Human operating error	0.11	70	0.0077	0.4
Design flaw	0.03	70	0.0021	0.1
Equipment **malfunction**	0.37	70	0.0259	1.3
Maintenance	0.07	70	0.0049	0.2
Weld **failure**	0.26	70	0.0182	0.9
Other	0.45	70	0.0315	1.6
Total, all unintentional releases, regardless of volume	2.88	70	0.2016	10.1
DOT **reportable** unintentional releases (50 **barrels** or greater) - **20-inch** line	1.10	70	0.0770	3.9

Table 3 Anticipated Unintentional Release Volume Distribution from Proposed New 70-Mile, 20-Inch-Diameter SFPP Pipeline

	A	B	C
Unintentional Release Volume, Barrels (gallons)	**Anticipated Incidents Per Year - Proposed New 70-Mile, 20-Inch-Diameter SFPP Pipeline**	**Anticipated Unintentional Releases Over 50-Year Project Life - Proposed New 70-Mile, 20-Inch-Diameter SFPP Pipeline**	**Anticipated Unintentional Releases Over 50-Year Project Life – Any 1-Mile Section of Proposed New 70-Mile, 20-Inch-Diameter SFPP Pipeline**
>1 (42)	**0.1925**	**9.63**	**0.138**
>5 (210)	**0.1470**	**7.35**	**0.105**
>10 (420)	**0.1225**	**6.12**	**0.088**
>50 (2,100)	**0.0770**	**3.86**	**0.055**
>100 (4,200)	**0.0584**	**2.92**	**0.042**
>500 (21,000)	**0.0341**	**1.71**	**0.024**
>1,000 (42,000)	**0.0269**	**1.34**	**0.019**
>5,000 (210,000)	**0.0095**	**0.47**	**0.007**
>10,000 (420,000)	**0.0048**	**0.24**	**0.003**

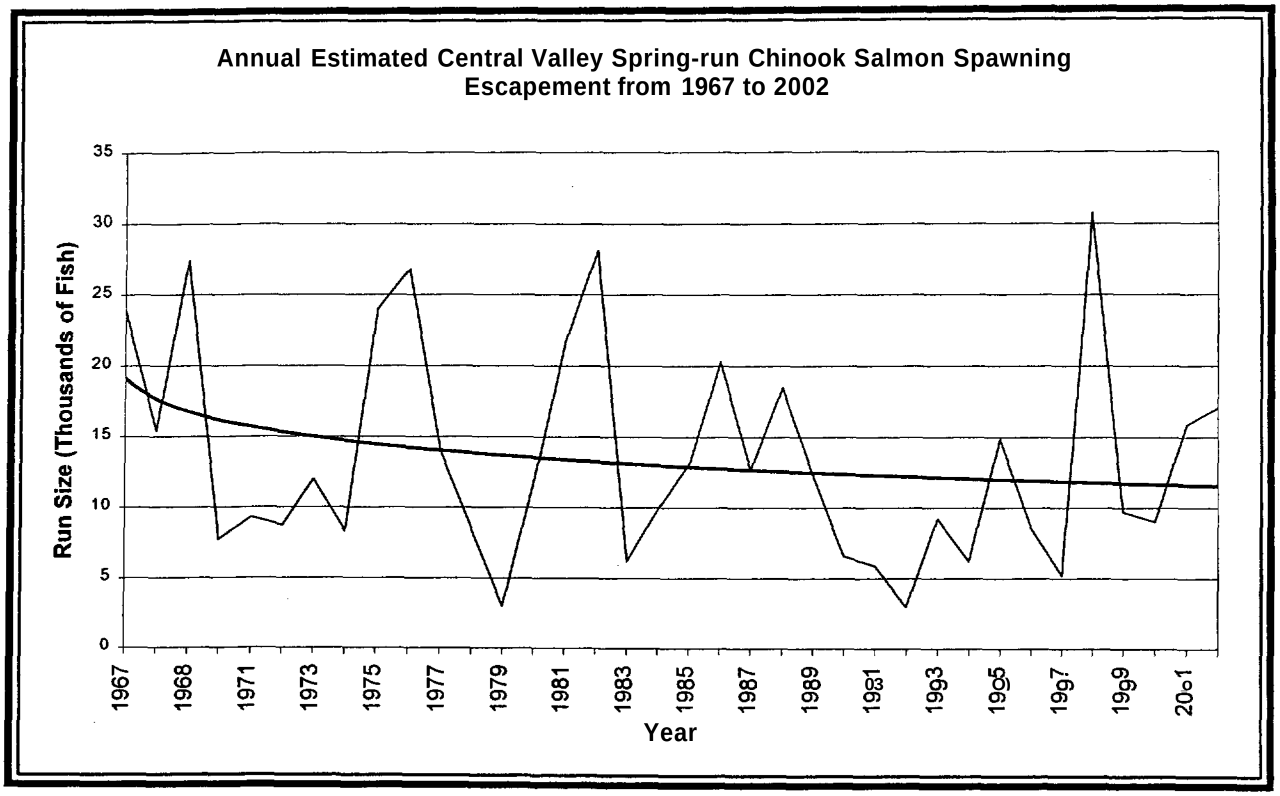
Tables 1-3 are taken from the Draft EIR (CSLC 2003)

Figure 1: Sources NMFS 1997 and PFMC 2002



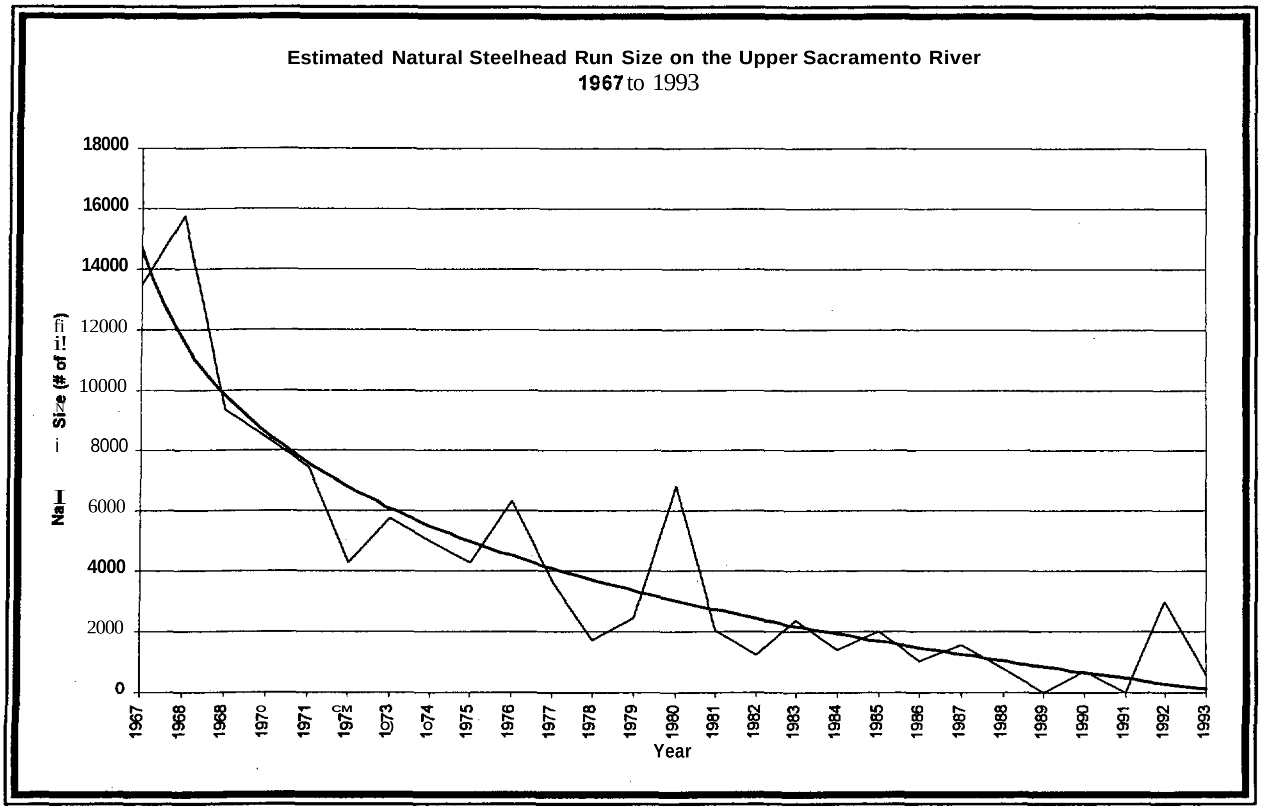
Trend line for Figure 2 is an exponential function: Y = 46.606 $e^{-0.1269x}$ R^2 = 0.5449

Figure 2: Source PFMC 2002, Yoshiyama 1998.



Trend line for Figure 3 is an exponential function: Y = -2.1276 Ln (x) + 19.146, **R^2** = 0.0597

Figure 3: Source McEwan and Jackson, 1996



Note: Steelhead escapement surveys at RBDD ended in **1993**

Trend line for Figure 4 is a logarithmic function: Y= -4419 Ln(x) + 14690 R^2 = 0.8574

Appendix A

Physical Effects and Avoidance Behavior in Fish due to Chemical Contamination

"The death of some organisms, such as mysids and larval fish, is easily detected because of a change in appearance from transparent or translucent to opaque. General observations of appearance and behavior, such as erratic swimming, loss of reflex, discoloration, excessive mucus production, hyperventilation, opaque eyes, curved spine, hemorrhaging, molting, and cannibalism, should also be noted in the daily record" (Section 10.1.3, Weber, 1993).

Overt Signs of Fish Distress

I. Respiratory stress - hyperventilation.
II. Disorientation in swim pattern, induced by narcosis.*
III. Mucus secretions from gills, mouth distension or "cough" reflex.

Behavioral Response

I. Actively move from area of contamination.
II. Reduced swimming rate.
III. Passively be carried away from the area (some chemical impact to fish).
IV. Lethal concentration causes fish mortality. Fish rise to water surface, ventral-side up, with distended belly, no respiration, rigor mortis.

*Narcosis: a general, nonspecific, reversible mode of toxic action that can be produced in most living organisms by the presence of sufficient amounts of many organic chemicals. Effects result from the general disruption of cellular activity. The mechanism producing this effect is unknown, with the main theories being binding to proteins in cell membranes and 'swelling' of the lipid portion of cell membranes resulting from the presence of organic chemicals. Hydrophobicity dominated the expression of toxicity in narcotic chemicals.

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Magnuson-Stevens Fisherv Conservation and Management Act (MSA)

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.C. 180 *et seq.)*, requires that Essential Fish Habitat (EFH) be identified and described in Federal fishery management plans (FMPs). Federal action agencies must consult with the National Marine Fisheries Service (NOAA Fisheries) on any activity which they fund, permit, or carry out that may adversely affect EFH. NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to the Federal action agencies.

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary' means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle. The proposed project site is within the region identified as Essential Fish Habitat (EFH) for Pacific salmon in Amendment 14 of the Pacific Salmon Fishery Management Plan and for starry flounder *(Platichthys stellatus)* and English sole (*Parophrys vetulus*) in Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan and foe Northern anchovy *(Engraulis mordax)* in Amendment 8 to the Coastal Pelagics Species Fishery Management Plan.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon Plan (Salmon Plan) (PFMC 1999). Freshwater EFH for Pacific salmon in the Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers *et al.* (1998), and includes the San Joaquin Delta hydrologic unit (i.e., number 18040003), Suisun Bay hydrologic unit (18050001) and the Lower Sacramento hydrologic unit (18020109). Sacramento River winter-run Chinook salmon *(Oncorhynchus tshawytscha)*, Central Valley spring-run Chinook salmon *(O. tshawytscha)*, and Central Valley fall-/late fall-run Chinook salmon *(O. tshawytscha)* are species managed under the Salmon Plan that occur in the San Joaquin Delta, Suisun Bay and lower Sacramento units.

Factors limiting salmon populations in the Delta include periodic reversed flows due to high water exports (drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversions, predation by introduced species, and reduction in the quality and quantity of rearing habitat due to channelization, pollution, rip-rapping etc. (Kondolf et al., 1996a, 1996b; Dettman et al. 1987; California Advisory Committee on Salmon and Steelhead Trout 1988). Factors affecting salmon populations in Suisun Bay include heavy industrialization within its watershed and discharge of waste water effluents into the bay. Loss of vital wetland habitat along the fringes of the bay reduce rearing habitat and diminish the functional processes that wetlands provide for the bay ecosystem.

LIFE HISTORY AND HABITAT REQUIREMENTS

Pacific Salmon:

General life history information for Central Valley Chinook salmon is summarized below. Information on Sacramento River winter-run and Central Valley spring-run Chinook salmon life histories is summarized in the preceding Biological Opinion for the proposed project (Enclosure 1). Further detailed information on Chinook salmon Evolutionarily Significant Units (ESU) are available in the NOAA Fisheries status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers et al. 1998), and the NOAA Fisheries proposed rule for listing several ESUs of Chinook salmon (NOAA Fisheries 1998).

Adult Central Valley fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from July through April and spawn from October through December (U.S. Fish and Wildlife Service [FWS] 1998). Chinook salmon spawning generally occurs in clean loose gravel in swift, relatively shallow riffles or along the edges of fast runs (NOAA Fisheries 1997).

Egg incubation occurs from October through March (Reynolds et al. 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson et al. 1982). The remainder of fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, aquatic and riparian vegetation, logs, and undercut banks provide habitat for food organisms, shade, and protect juveniles and smolts from predation. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean. Whether entering the Delta or estuary as fry or juvenile, Central valley Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean.

Starry Flounder:

The starry flounder is a flatfish found throughout the eastern Pacific Ocean, from the Santa Ynez River in California to the Bering and Chukchi Seas in Alaska, and eastwards to Bathurst inlet in

Arctic Canada. Adults are found in marine waters to a depth of 375 meters. Spawning takes place during the fall and winter months in marine to polyhaline waters. The adults spawn in shallow coastal waters near river mouths and sloughs, and the juveniles are found almost exclusively in estuaries. The juveniles often migrate up freshwater rivers, but are estuarine dependent. Eggs are broadcast spawned, and the buoyant eggs drift with wind and tidal currents. Juveniles gradually settle to the bottom after undergoing metamorphosis from a pelagic larvae to a demersal juvenile by the end of April. Juveniles feed mainly on small crustaceans, barnacle larvae, cladocerans, clams and dipteran larvae. Juveniles are extremely dependent on the condition of the estuary for their health. Polluted estuaries and wetlands decrease the survival rate for juvenile starry flounder. Juvenile starry flounder also have a tendency to accumulate many of the contaminants in the environment.

English Sole:

The English sole is a flatfish found from Mexico to Alaska. It is the most abundant flatfish in Puget Sound, Washington and is abundant in the San Francisco Bay estuary system. Adults are found in nearshore environments. English sole generally spawn during late fall to early spring at depths of 50 to 70 meters over soft mud bottoms. Eggs are initially buoyant, then begin to sink just prior to hatching. Incubation may last only a couple of days to a week depending on temperature. Newly hatched larvae are bilaterally symmetrical and float near the surface. Wind and tidal currents carry the larvae into bays and estuaries where the larvae undergo metamorphosis into the demersal juvenile. The young depend heavily on the intertidal areas, estuaries and shallow near shore waters for food and shelter. Juvenile English sole feed on small crustaceans such as copepods, amphipods, and on polychaete worms. Polluted estuaries and wetlands decrease the survival rate for juvenile English soles. The juveniles also have a tendency to accumulate many of the contaminants found in their environment and this exposure manifests itself as tumors, sores, and reproductive failures.

Northern Anchovy:

All lifestages of the northern anchovy can be found within the estuarine reaches of San Francisco Bay, San Pablo Bay and Suisun Bay. It is perhaps the most abundant fish found in San Francisco Bay waters. The northern anchovy feeds primarily on planktonic crustaceans and fish larvae and is in turn the food base for many species of fish, including Pacific salmon, California halibut, rockfish, tuna, sea bass, and sharks. It is also an important prey species for many marine mammals and seabirds. The northern anchovy spawns throughout the year, generally within 100 kilometers of shore or within the open waters of bays along the coast from Baja California to British Columbia. Eggs are broadcast spawned into the water column where they float until hatching. Larval anchovies emerge in two to four days and absorb their yolk sacs within 36 hours. Larvae and post-larvae are very abundant in San Francisco and San Pablo Bays and occupy near surface habitat. As the influence of the salinity wedge progresses up into the Delta during summer months, juvenile anchovies become more prevalent in the surface waters of Suisun Bay. They are particularly common in the months of July and August. The juveniles use inshore bays and estuaries as their nursery ground, while the offshore waters are utilized as adult recruitment areas.

II. PROPOSED ACTION

The proposed action is described in Part II *Description of the Proposed Action* of the preceding Biological Opinion for endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, Central Valley steelhead, California Central Coast steelhead and critical habitat for winter-run Chinook salmon (Enclosure 1).

III. EFFECTS OF THE PROJECT ACTION

The effects of the proposed action on Sacramento River winter-run and Central Valley spring-run Chinook salmon habitat are described at length in Section V *(Effects of the Action)* of the preceding biological opinion, and generally are expected to apply to central Valley fall-run Chinook salmon EFH. The effects on EFH the two species of flatfish are expected to be similar to those for salmon. The effects on EFH for Northern anchovy will be slightly different than those for the other species. Northern anchovy are broadcast spawners and the fertilized eggs will float in the top epi-pelagic zone of Suisun Bay while developing. These eggs are at an elevated risk of exposure to surface contamination during this phase, and an oil spill could be devastating to their viability.

IV. CONCLUSION

Based on the best available information, NOAA Fisheries believes that the proposed SFPP Concord to Sacramento Petroleum Products Pipeline during its construction and normal operations may adversely affect EFH for Central Valley fall-/late fall-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Central Valley spring-run Chinook salmon managed under the Salmon plan. Likewise, the pipeline may adversely affect EFH for starry flounder, English sole and Northern Anchovy in the action area.

V. EFH CONSERVATION RECOMMENDATIONS

NOAA Fisheries recommends that terms and conditions la, b, and d from the biological opinion be adopted as EFH Conservation Recommendations for EFH in the action area. In addition, certain other conservation measures need to be implemented in the project area, as addressed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999).

Riparian Habitat Management- Santa Fe Pacific Partners (SFPP) will cross approximately 64 watercourses during the construction of the proposed pipeline. In order to prevent adverse effects to the riparian corridor, the US Army Corps of Engineers (Corps) and SFPP should:

- Maintain riparian management zones of appropriate width on all waterways that include or influence EFH.

- Reduce erosion and runoff into waterways within the affected watersheds.

- Minimize the use of chemical treatments within the riparian management zone to manage nuisance vegetation along the pipeline alignment.

Bank Stabilization- The installation of rip rap or other streambank stabilization devices can reduce or eliminate the development of side channels, functioning riparian and floodplain areas and off channel sloughs. In order to minimize these impacts, the Corps and SFPP should:

- Use vegetative methods of bank erosion control whenever feasible. Hard bank protection should be a last resort when all other options have been explored and deemed unacceptable.

- Determine the cumulative effects of existing and proposed bio-engineered or bank hardening projects on salmon EFH, including prey species before planning new bank stabilization projects.

- Develop plans that minimize alterations or disturbance of the bank and existing riparian vegetation.

VI. STATUTORY REQUIREMENTS

Section 305 (b) 4(B) of the MSA requires that the Federal lead agency provide NOAA Fisheries with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by the lead agency for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920[j]). In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreement with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

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